ISO 9001 CERTIFIED

#502-PD-RC-001-00

PosiDrive™ Series RC

DIGITAL SERVO MOTOR CONTROL & AMPLIFIER

INSTALLATION MANUAL

FORCE CONTROL®

Force Control Industries, Inc.

WARNING – Read this manual before attempting any installation of the *PosiDrive* Digital Servo Motor Control and Amplifier.

Record of Manual Revisions

Issue No.	Date	Brief Description of Revision
00	05/10/02	Preliminary Issue

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Windows® is a register trademark of Microsoft Corporation
EnDat™ is a trademark of Dr. Johannes Heidenhain GmbH
PosiDrive is a pending trademark of Force Control Industries, Inc.

Copyright Information

NOTICE:

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SAFETY INSTRUCTIONS

Only qualified personnel are permitted to transport, assemble, commission, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their jobs. The qualified personnel must know and observe the following standards and regulations:

IEC 364 resp. CENELEC HD 384 or DIN VDE 0100
IEC report 664 or DIN VDE 0110
National regulations for safety and accident prevention or VBG 4

Read all available documentation before assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

It is vital to ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

The *PosiDrive RC* product contains electrostatically sensitive components that can be damaged by incorrect handling. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface. Ground yourself (discharge any possible static electricity build-up) by touching an unpainted, metal, grounded surface before touching the equipment.

Keep all covers and cabinet doors shut during operation. Otherwise, potential hazards could cause severe personal injury or damage to the product.

Be aware that during operation, the product has electrically charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating.

Never disconnect or connect the product while the power source is energized to avoid electric arcing and hazards to personnel and electrical contacts.

After removing the power source from the equipment, wait at least 10 minutes before touching or disconnecting sections of the equipment that normally carry electrical charges (e.g., capacitors, contacts, screw connections). To be safe, measure the electrical contact points with a meter before touching the equipment.

These symbols indicate a potential for personal injury or equipment damage if the recommended precautions and safe operating practices are not followed. Read and be familiar with the safety notices in this manual before attempting installation, operation, or maintenance to avoid serious bodily injury, damage to the equipment, or operational difficulty.

Warning identifies hazards that could result in personal injury or death

Caution identifies hazards that could result in personal injury or equipment damage.

Note identifies information critical to the user's understanding or use of the equipment.

Directives and Standards

The ***PosiDrive*** *RC* product series has been successfully tested and evaluated to meet UL/cUL 508C for U. S. and Canadian markets. This standard outlines the minimum requirements for electrically operated power conversion equipment (frequency converters and servo amplifiers), which are intended to eliminate the risk of fire, electric shock, or injury to persons, being caused by such equipment.

Mark Conformance

Servo drives are incorporated in electrical plants and machines for industrial use. When the servo drives are built into machines or plants, the operation of the drive is prohibited until the machine or plant meets the requirements of the EC Directive on Machines 89/392/EEC and the EC Directive on EMC (89/336/EEC). EN 60204 and EN 292 must also be met.

In connection with the Low Voltage Directive 73/23/EEC, the harmonized standards of the EN 50178 series are applied to the amplifiers, together with EN 60439-1, EN 60146 and EN 60204.

The manufacturer of the machine or plant is responsible for ensuring that they meet the limits; which are required by the EMC regulations. Advice on the correct installation for EMC - such as shielding, grounding, arrangement of filters, treatment of connectors and the lay out of cabling can be found in this documentation.

Conformance with the EC Directive on EMC 89/336/EEC and the Low Voltage Directive 73/23/EEC is mandatory for the supply of servo drives within the European Community.

The servo drives have been tested by an authorized testing laboratory in a defined configuration with the system components; described in this documentation. Force Control Industries, Inc. is not responsible for any divergence from the configuration and installation described in this documentation and is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.

Force Control Industries, Inc.'s ***PosiDrive*** products and systems have been successfully tested and evaluated to the limits and requirements of the EC Directive on EMC (89/336/EEC) and the EC Directive on Low Voltage (72/73/EEC). The product lines have been evaluated to EN50178 and EN60204 as a component of a machine and other relevant standards.

The Electromagnetic Compatibility (EMC) of a system is identified in two parts: emissions and immunity. Emissions are the generation of EMI (electromagnetic interference) and immunity is the susceptibility levels of the equipment. Limits are derived from generic standards EN55081-2 and EN55082-2 for heavy industrial environment. The ***PosiDrive*** series of drives and BUS Modules have been tested for radiated emissions, conducted emissions, EFT, ESD, surge, conducted immunity, and radiated immunity. These tests have been in accordance with EN55011, EN61000-4-2, ENV50140, IEC 1000-4-4, EN61000-4-5, and ENV50141.

Installation of the equipment is critical in designing system and machine electro-magnetic compatibility (EMC). The user must apply the installation recommendations in this manual. See the installation section and CE Filtering Techniques information when mounting and installing the drive system for CE conformance.

READ BEFORE INSTALLING

The directions below are the brief steps for easy installation and setup, and application implementation of a *PosiDrive RC* system. Further explanation of these steps follows in this document.

Detailed instructions are provided in the PosiDrive® RC Installation Manual.

1. Open the box and remove all the contents. Check to ensure there is no visible damage to any of the equipment.
2. Mount the *PosiDrive RC* to the back panel.

Wire the *PosiDrive RC* according to the System Wiring diagrams.

1. **Logic Power** (*for details, refer to the Electrical Specifications and Logic Power Diagram*)
   - A. Apply 24 VDC to terminal 7 on connector C13.
   - B. Connect DC Common to terminal 8 on connector C13.
   - C. To daisy chain power:
     - a. Apply 24 VDC to terminal 5 on connector C13.
     - b. Connect DC Common to terminal 8 on connector C13.

Pin 5 is internally connected to Pin 7. Pin 6 is internally connected to Pin 8.

2. **AC Power** (*for details, refer to the Electrical Specifications and the Power Diagrams*)
   - A. Wire the AC power to terminals L1, L2, and L3 on the front of the *PosiDrive RC* controller.
   - B. Single-phase power can be connected to any combination of L1, L2, and L3.

3-Amp models (RC-03) can be wired for 115VAC/1ø **or** 230VAC/1ø **or** 230VAC/3ø.
6-Amp models (RC-06) can be wired for 115VAC/1ø **or** 230VAC/1ø **or** 230VAC/3ø.
10-Amp models (RC-10) can only be wired for 230VAC/3ø.

3. **Motion Inputs** (*Refer to the appropriate Connector Diagram*)
   - A. Hardware Enable
     - a. Apply 24VDC to terminal 8 on connector C3.
     - b. Wire DC Common to terminal 7 on connector C3.
   - B. Motion Enable
     - a. Apply 24VDC to terminal 2 on connector C9.
     - b. Wire DC Common to terminal 1 on connector C9.
4. **Motor and Feedback** (*Refer to the Main Power Diagram and the appropriate Feedback Diagram*)
   - A. Connect the motor cable to terminals M1, M2, and M3 on the front of the *PosiDrive RC* controller.
   - B. Connect the feedback cable to connector C2 on the front of the *PosiDrive RC* controller.

5. **Inputs and Outputs** (*Refer to the appropriate I/O Diagram*)
   A. Connect the various inputs and outputs (see pages 24 through 27. Pay particular attention to the sinking and sourcing diagrams (pages 27 and 27) for further information.
   B. Connect the Encoder inputs according to the appropriate diagram (page 23).
6. **Communication and Software Setup**

DO NOT USE connector C1!

To establish communication, read the Software Installation section of this guide and follow the procedures outlined in this section.

If communicating between a PC and the *PosiDrive RC*, a "crossed" serial or Ethernet cable must be used.

   A. **Serial Communication**
   Connect the serial cable to connector C7.
   B. **Ethernet Communication**
   Connect the Ethernet cable to connector C6.
7. **Dip Switches** (see also page 29). The settings should be:

Switch 1 = 1
Switch 2 = 0
Switch 3 = 0
Switch 4 = 0
Switch 5 = 0
Switch 6 = 1
Switch 7 = 0
Switch 8 = 0
Switch 9 = 0
Switch 10 = 0

The switch is set to 1 (high) if it is turned to the right as you look at the front of the *PosiDrive RC* controller.

The switch is set to 0 (low) if it is turned to the left as you look at the front of the *PosiDrive RC* controller.

8. **Install and Configure**
   A. Install and configure the Software on your PC. Be sure to read and follow the instructions in the Software Installation section.
9. **Motor Selection**
   A. Using the Startup Wizard in the Software, select your particular motor.
   B. Configure the *PosiDrive RC* for your particular motor, if this was not done at the factory.
10. **Tuning** *(Refer to the Tuning section for further details)*
   A. Using the Startup Wizard in the Software, tune the *PosiDrive RC* velocity loop for the motor and load.
   B. Enable the system.

11. Programming Tips

A. Develop an application using the Software. A sample "Getting Started Program" is provided in this document (see the table of contents) as well as in the ***PosiDrive***® *RC Installation Manual*.

B. The Config.prg program (task) starts automatically when the ***PosiDrive*** *RC* is powered up. Use it to define global variables.

C. The Autoexec.prg program (task) automatically starts when the ***PosiDrive*** *RC* is powered up. Use it to start other tasks that control the application.

D. When giving position, speed, or acceleration commands, the following units are available:

Resolver-based motors have 65,636 counts per motor revolution

Encoder-based motors have counts equal to "4x encoder line" per motor revolution (i.e., a motor with 2048 lpr encoder has 8192 counts per motor revolution).

	Rotary Units	Linear Units
Position	Counts	mm
Velocity	rpm	min/sec
Acceleration	rpm/sec	min/sec^2

12. LED Display

"0" flashing – occurs at initial power-up of the logic circuit.

"S" flashing – second phase of power-up sequence. This shows the controller is in "Conmode=1."

"8" displayed – indicates the drive is in position mode.

"0" displayed – indicates the drive is in velocity mode.

"1" displayed – indicates the drive is in analog velocity mode.

"." (decimal point) displayed at bottom corner – indicates drive is enabled.

"C2" flashing – indicates a fault and indicates the controller is in "Conmode=0." To eliminate the C2 fault, reset the motion flag by doing one of the following:

- Toggle the Motion Enable input on terminal 2 of connector C9.
- Type "sys.motion=1" from the terminal screen.
- Reset the Motion radio button in the bottom of the main Software screen.

13. Conmode

A. The ***PosiDrive*** has two Conmodes:

a. **Conmode One**: ("S" displayed) compensating for a particular motor or changing a motor parameter.

b. **Conmode Two**: ("8" or "0"displayed) changing all other parameters, enabling the drive and performing motion.

B. Changing Conmodes

a. Conmode is changed in the Software main screen by the drop-down menu, "Conmode"

b. Conmode is changed at the Terminal screen in the Software by typing the command “sys.conmode = 1” or “sys.conmode = 2”

UNPACKING AND INSPECTING

Open the box and remove all the contents. Check to ensure there is no visible damage to any of the equipment.

Electronic components in this amplifier are design-hardened to reduce static sensitivity. However, proper procedures should be used when handling to avoid damage to equipment.

Remove all packing material and equipment from the shipping container. Be aware that some connector kits and other equipment pieces may be quite small and can be accidentally discarded if care is not observed when unpacking the equipment. Do not dispose of shipping materials until the packing list has been checked.

Upon receipt of the equipment, inspect components to ensure that no damage has occurred in shipment. If damage is detected, notify the carrier immediately. Check all shipping material for connector kits, documentation, diskettes, CD-ROM, or other small pieces of equipment.

Warranty Information

All products covered in this manual are warranted to be free of defects in material and workmanship and to conform to the specifications stated either in this document or product catalog description. All Force Control Industries, Inc. brushless motors and electronics are warranty for a period of 12 months from the time of shipment. There are no other warranties, expressed or implied (including the warranty of merchantability and fitness for a particular purpose, which extends beyond this warranty. Force Control Industries, Inc. warrants that the products covered in the manual are free from patent infringement when used for normal purposes.

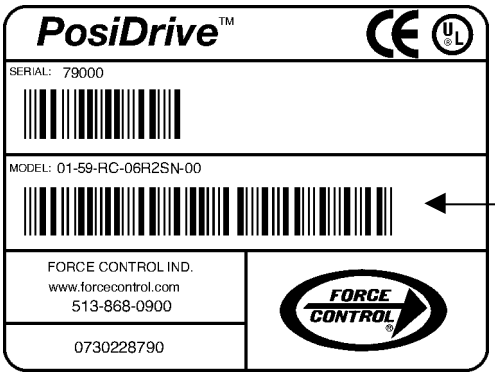
Use As Directed

The following guidelines describe the restrictions for proper use of the *PosiDrive RC* system:

- The amplifiers are components built into electrical equipment or machines and can only be commissioned as integral components of such equipment.
- The servo amplifiers are to be used only on earthed three-phase industrial mains supply networks (TN-system, TT-system with earthed neutral point).
- The servo amplifiers must not be operated on power supply networks without an earth or with an asymmetrical earth.
- If the servo amplifiers are used in residential areas, or in business or commercial premises, the user must implement additional filter measures.
- The servo amplifiers are only intended to drive specific brushless synchronous servomotors from Force Control Industries, Inc. with closed-loop control of torque, speed, and position. The rated voltage of the motors must be at least as high as the DC-link voltage of the servo amplifier.
- The servo amplifiers may only be operated in a closed switchgear cabinet, taking into account the ambient conditions defined in the environmental specifications.

Force Control Industries, Inc. guarantees the conformance of the servo amplifiers with the standards for industrial areas stated in this manual only if Force Control Industries, Inc. delivers the components (motors, cables, amplifiers etc).

Name Plate and Model Number



PosiDrive Series RC CONTROL MODEL NUMBER

				1	2	3	4	5	6	7	8	9
01-59-	R	C	-					S	N	-		
	Series RC											

ENGINEERING (8, 9) REVISION

AMPS (1, 2)

0	3	= 3 Amps
0	6	= 6 Amps
1	0	= 10 Amps

FEEDBACK (3)

R	= Resolver
E	= Encoder, Incremental

OPTIONS (6)

N	= None

CONFIGURATION (5)

S	= Standard

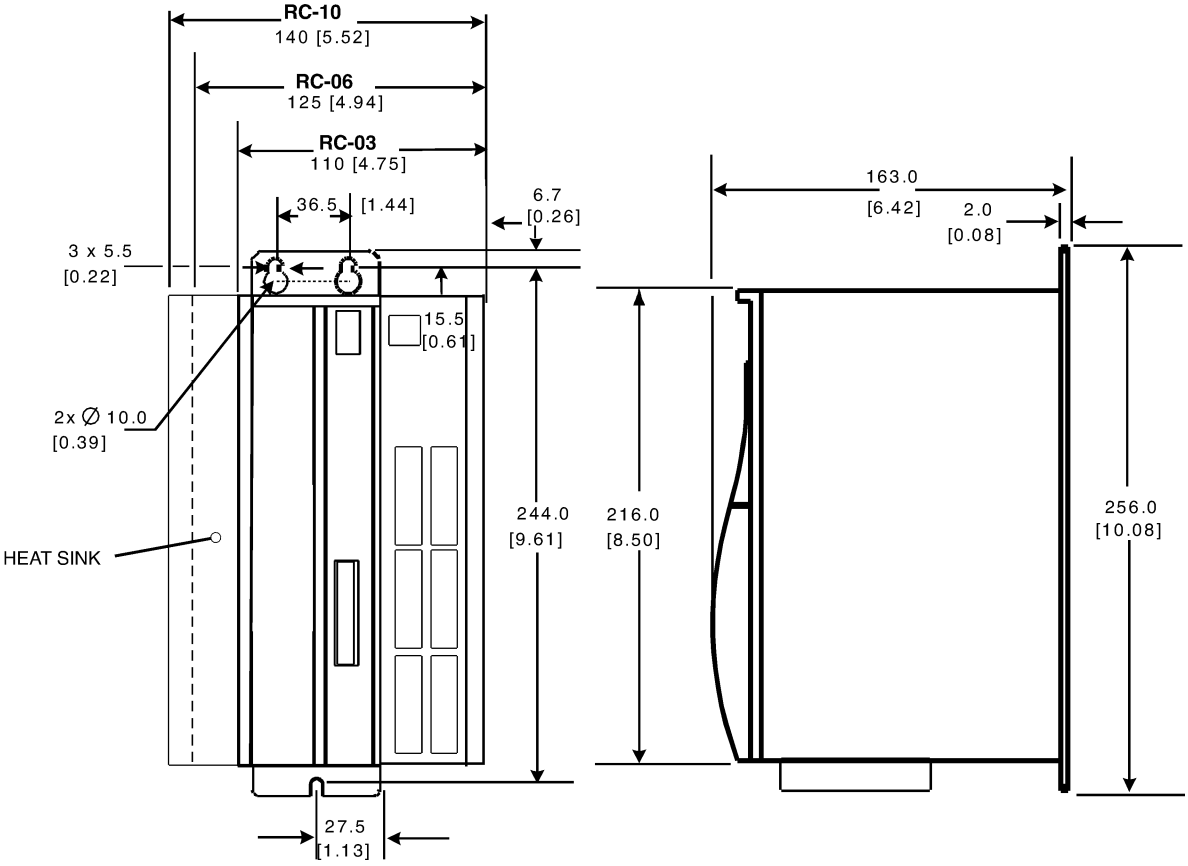
VOLTAGE (4)

1	= 115 VAC
2	= 230 VAC

MOUNTING

The *PosiDrive RC* controller is mounted vertically to the back panel for proper ventilation. These products are designed for mounting inside an electrical enclosure to protect them from physical and environmental damage.

Outline Dimensions



Hardware Specifications

Controller Model		RC-03	RC-06	RC-10
Unit Weight	lbs / Kgs	4.68 / 2.12	5.20 / 2.36	7.08 / 3.21
Mounting Hardware	English (Metric)	10-32 (M4)		
	Applied Torque	20lb-in (2.26Nm)		
Connection Hardware	Line RCrew Size/Torque	M3.5 / 12lb-in (1.35Nm)		
	Motor RCrew Size/Torque			
	Ground RCrew Size/Torque			
Wire Size (AWG#)	Control Logic (AWG/ mm^2)	28 – 16 / 0.5 – 1.5		
	Motor Line (AWG/ mm^2)	14 / .25		
	Main Input (AWG/ mm^2)	14 / .25	12 / 4	
	Configurable I/O wire gauge	22-18 AWG (.3-.75mm^2) Ferrules recommended: 18 AWG Type H1 - 0/14 Weidmuller 4630.0 or equivalent 20 AWG Type H0 - 75/14 Weidmuller 4629.0 or equivalent		
	Spade Terminals	16/14 AWG (1.5mm^2): Hollingsworth XSS0954S OR SS20947SF or equivalent 12/10 AWG (4-6mm^2): Hollingsworth XSS20836 OR SS20832F or equivalent		
	Ring Terminals	8 AWG (10mm^2): Hollingsworth R3027BF or equivalent 6 AWG (16mm^2): Hollingsworth R4001BF or equivalent 4 AWG (25mm^2): Hollingsworth R5100BF or equivalent 2 AWG (35mm^2): Hollingsworth R7998BFN or equivalent		
Clearance Distance	Side-to-Side	.5in (12.7mm)		
	Top/Bottom	2.5in (63.5mm)		
Mating Connector Hardware	CK100 Kit	Includes: C1, C2, C4, C7 (plus 2-ft / 0.69m of stranded bus ribbon), C8		
	C3	Force Control Industries, Inc. Vendor Info: Weidmuller BL3.5/13 Cat.No. 161574		
	C5	Force Control Industries, Inc Vendor Info: PCD ELFP04110		
	Connector RCrew Torque	2.25 lb.-in (0.25m)		
	C9, C10, C11, C12, C13, C14	Force Control Industries, Inc. Vendor Info: Weidmuller 160948		
		Pin Coding Element, Vendor Info: Weidmuller 169343		

WIRING THE *POSIDRIVE RC*

Wire the *PosiDrive RC* according to the System Wiring Diagrams (pages 22 through 29. Be sure to apply 24 VDC for power to C13, 24 VDC for motion to C9, and apply 24 VDC for hardware enable to C3. Wire the power (115/230 VAC). Wire the motor and feedback. Refer to the appropriate Feedback Wiring Diagram (page 31 or 32) for additional information.

Wiring Requirements

Particular care should be used when layout of an enclosure is designed. Separate power wires from small signal wires. The following guidelines highlight some important wiring practices to implement:

- Control and signal cables must be separated from power and motor cables. Distance of 8 inches (20centimeters) is sufficient in most cases.
- Control and signal cables must be shielded to reduce the effects of radiated interference.
- When control cables must cross power or motor cables, they should cross at an angle of 90 degrees, if possible. This reduces the field coupling effect.

Grounding

System grounding is essential for proper performance of the *PosiDrive RC* system. A ground bus bar is used as a single point ground for the system. Safety grounding is provided to all pieces of the system from a “star point”. In addition to the safety grounding, a high frequency ground must be provided that connects the back panel to the enclosure, and ultimately to earth ground. This provides an extremely low impedance path between the filters, drives, power supplies, and earth ground. This high frequency ground is made with the use of a flat braid or copper bus bar. Do not use a standard wire for the high frequency ground. When connecting high frequency grounds, use the shortest braid possible.

Bonding

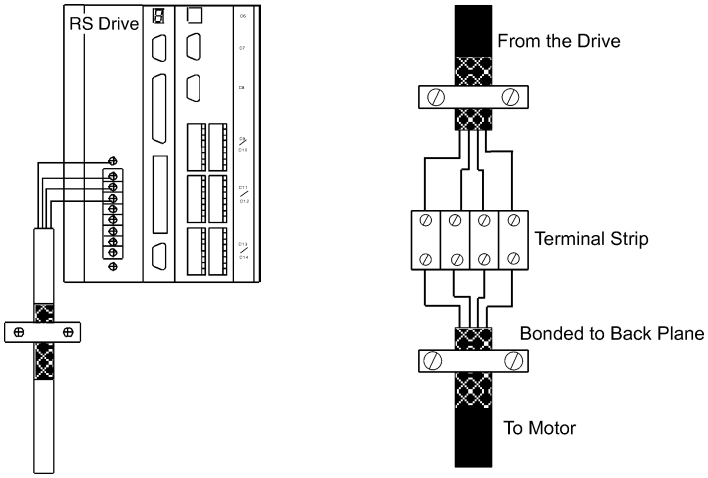
The proper bonding of shielded cables is imperative for minimizing noise emissions and increasing immunity levels of the *PosiDrive RC* system. Its effect is to reduce the impedance between the cable shield and the back panel. Force Control Industries, Inc. recommends that all shielded cables be bonded to the back panel.

Power input wiring does not require shielding (RCreening) if the power is fed to the cabinet (enclosure) via metallized conduit. If metallized conduit is not implemented into the system, shielded cable is required on the power input wires and proper bonding technologies should be implemented.

The motor and feedback cables should have the shield exposed as close to the *PosiDrive RC* as possible. This exposed shield is bonded to the back panel using one of the two suggested methods below.

NON-INSULATED CABLE CLAMP

The following figures shows how cable bonding is implemented using non-insulated metallic cable clamps. The first figure demonstrates clamping to the back panel in the vicinity of the *PosiDrive RC*. The second shows a technique for bonding a terminal strip (for best results, it is recommended not to break the shielding of the cable).

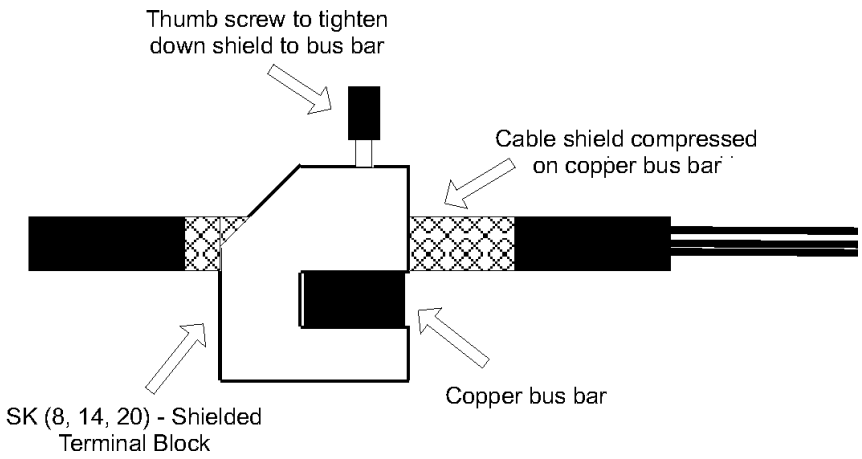


ALTERNATIVE BONDING METHODS

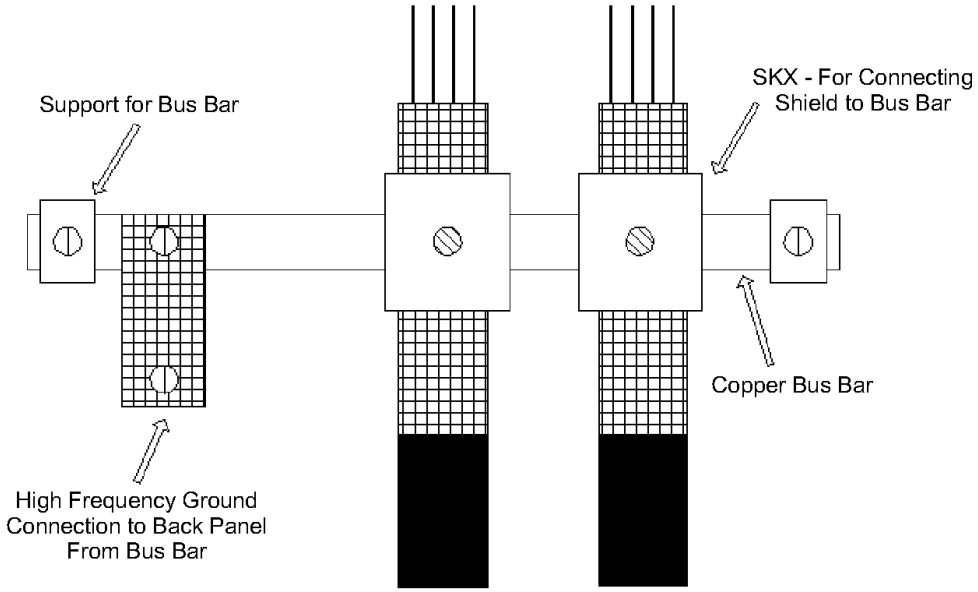
Another option is to use cable bonding clamps (offered by Phoenix Contact and others). When using the Phoenix Contact parts, ensure that a low impedance (high frequency) ground is connected from the ground bus bar to the back panel using either a flat braid or a copper bus bar. The SK parts from Phoenix (SK8, SK14, & SK20) slide onto the bus bar. The cable (with exposed shield) is inserted through the SK piece and the thumbRCrew on top of the SK piece is used to tighten the connection between the cable shield and the bus bar.

Phoenix Contact Part #	DeRCription	Cable Diameter Range
3025163 Type SK8	Shielded terminal block - for placing the shield on bus bars.	SK8 up to 8mm or 0.315 inches
3025176 TypeSK14	Shielded terminal block - for placing the shield on bus bars.	SK14 8mm to 14mm or 0.551 inches
3025189 Type SK20	Shielded terminal block - for placing the shield on bus bars.	SK20 14mm to 20mm or 0.787 inches
0404428 Type AB/SS	Support for bus bar. 2 needed to mount ground bus.	N/A
0402174 Type NLS-CU 3/10	Bus bar material - 10mm x 3mm copper at varying lengths.	N/A

The next two figures represent a side and top view of the SK device that clamps down on the shield of the cable. The use of the Phoenix SK device is an excellent method for providing a low impedance path between the cable shield and the back panel.



Phoenix Contact - Side View



Phoenix Contact -Top View

System Interconnect

Connector information and the system connections up to the motor power and feedback connections are listed in the following tables.

Electrical Specifications

Product Model		RC-03	RC-06	RC-10
Main Input Power	Voltage (Vac_{L-L}) Nominal ±10%	110-230		230
	115Vac 1φ / 3φ	1 / 3		
	230Vac 1φ / 3φ	1 / 3		3φ only
	Line Frequency	47-63		
	KVA at 115 (1φ)	0.44	0.89	
	Continuous Current (amps) at 115VAC	3.9	7.7	
	Peak Current (amps) for 500 mSec 115VAC	11.7	23.1	
	Peak Current (amps) for 2 Sec 115AC	7.8	15.4	
	KVA at 230 (1φ)	0.89	1.8	
	Continuous Current (amps) at 230 (1φ)	3.9	7.7	
	Peak Current (amps) for 500mSec at 230 (1φ)	11.7	23.1	
	Peak Current (amps) for 2Sec at 230 (1φ)	7.8	15.4	
	Line Fuses (FRN-R, LPN, or equivalent)	10	20	
	KVA at 230 (3φ)	1.4	2.8	4.6
	Continuous Current (amps) at 230 (3φ)	3.5	7	12
	Peak Current (amps) for 500mSec at 230 (3φ)	10.5	21	36
	Peak Current (amps) for 2Sec at 230 (3φ)	7	14	24
	Line Fuses (FRN-R, LPN, or equivalent)	10	20	25
Protection Functions	Fault Contact Rating	1A		
	Fault Contact Closing Period (mSec)	Close = 3mS, Open = 2mS		
	OverTemperature trip (°C)	80°C		
	UnderVoltage Trip (nominal)	90 VDC		
	OverVoltage Trip	430 VDC		
	OverTemperature Trip	80°C		
	Internal heat dissipation (watts)	70	90	142
Logic Input Power	+24VDC Ext. Logic Voltage (volts)	20 - 28		
	+24VDC Ext. Logic Current (amps sink)	1.5A		
SoftStart	Max. Surge Current (amps)	30		
	Max. Charge Time (sec)	0.25		
Environment	Operation temperature (°C)	5 to 45°C		
	Storage temperature (°C)	-0 to 70		
	Ambient humidity	10% to 90%		
	Atmosphere	w/o no corrosive gasses or dust		
	Altitude	Derate 5% per 1000-ft (300m) above 3300-ft (1000m)		
	Vibration	0.5 g		

Product Model		RC-03	RC-06	RC-10
Rated Main Output (Ma, Mb, Mc)	Continuous Power (KVA) at 115VAC 1φ Line Input (45° Ambient)	0.35	0.7	
	Continuous Power (KVA) at 230VAC 1φ Line Input (45°C Ambient)	0.7	1.4	
	Continuous Power (KVA) at 230VAC 3φ Line Input(45° Ambient)	1.1	2.2	3.5
	Continuous Current (Arms)	3	6	10
	Peak Current (Arms) for 500 mSec	9	18	20
	Peak Current (Arms) for 2 Sec	6	12	20
	PWM Frequency (kHz)	16	16	8
	PWM Motor Current Ripple (kHz)	32	16	16
	Form Factor (rms/avg)	≤1.01		

Regen Information

Product Model		RC-03	RC-06	RC-10
External Shunt Regulator	Peak current (amps)	20		
	Minimum resistance (Ω)	20		
	Watts	200		
Application Information	Capacitance (Farads)	0.00082	0.00164	
	V_{HYS} (Regen circuit turn-off) (VDC)	370		
	V_{MAX} (Regen circuit turn-on) (VDC)	390		
External Regen Kits	ERH-26	a	a	a

Control Specifications

Connector		Control Specification
Current Loop	Update Rate	62.5 µS (16kHz)
	Bandwidth	<2000Hz
Commutation Loop	Update Rate	62.5 µS (16kHz)
	Output Waveform	Sinusoidal
Velocity Loop	Update Rate	250 µS (4kHz)
	Bandwidth	<400Hz
	Maximum/Minimum Speed	500Hz /[Serial: 1 RPM or Analog: (1/2048) x VMAX)
	Long-term Speed Regulation	0.01% (µP clock tolerance)
Position Loop	Update Rate	500 µS (2 kHz)
Reference Generator Loop	Update Rate	1 mS (1 kHz)
Resolver Feedback on RC-xxR Models (C2)		
Type	Control Transmitter	
Transformer Ratio	0.47	
Modulation Frequency	7 to 8 kHz	
Input Voltage (from drive)	4.25VAC	
Max DC Resistance	120Ω	
Max Drive Current	55 mA AC-RMS	

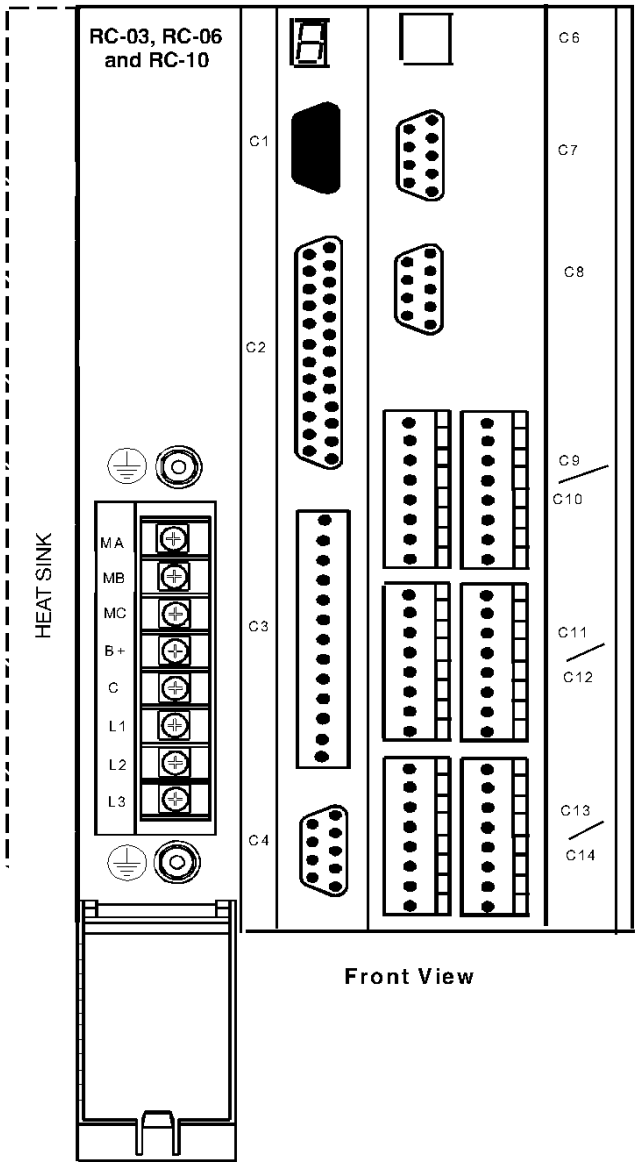
Connector		Control Specification
Output Voltage (to drive)	2VAC	
Digital Encoder Feedback on RC-xxE Models (C2)		
Required Signals		A, B with or without Index pulse A, B Index with or without Halls Channels *Halls may be integral or diRCrete
Signal Type	A-quad-B and Marker	Differential: do not connect single-ended
	Halls	Differential or open collector
System Voltage		5VDC
Maximum Input Frequency		3MHz (or 12MHz after quadrature)
Maximum Cable Length		System Dependent: 50-ft (15m) recommended
Maximum Line Count		10,000,000 Lines per motor electrical cycle
Maximum Supply Current (from RC)		250mA
Protection		Separate voltage regulator, broken wire detector for A, B, Index, and Hall channels, illegal Hall code detection
Sine Encoder Feedback on XX-xxX Models (C2)		
Required Signals		A, B with or without Index pulse A, B Index with or without Halls Channels *Halls may be integral or diRCrete
Signal Type	A-quad-B and Marker	Differential: do not connect single-ended
	Halls	Differential or open collector
System Voltage		5VDC
Maximum Input Frequency		3MHz
Maximum Cable Length		System Dependent: 50-ft (15m) recommended
Maximum Line Count		10,000,000 Lines per motor electrical cycle
Maximum Supply Current (from RC)		250mA
Protection		Separate voltage regulator, broken wire detector for A, B, Index, and Hall channels, illegal Hall code detection
I/O Connector (C3 by pinout)		
Analog Input 1 (2, 3)ANIN1	Maximum Voltage	± 12 V differential/single-ended
	Input Resolution	AIN_1 – 14 bit + Dual Gain (15 bit)
	Sensitivity	0.3mV/Bit
	Voltage Range	± 10 V (Standard / ReRCaled)
	Input Impedance / CMR	10^{12} Ohms
	Long-term Drift	100 ppm (0.075%/°C)
Fault Output Relay (5, 6)	Max Capacity	1 A at 24 VDC
Remote Enable (7, 8) Configurable Inputs(9, 10, 11) IN1,IN2,IN3 Configurable Inputs Common (7)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 V to 24 V Nominal
	Min. On / Max. Off	10 V/1 V
	Current Demand per Input	20mA
Brake Control Digital Output (7, 12) O1 *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=34V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA
Configurable Analog Output 1 (13, 4) ANOUT1	Max. Output Current	1 mA (1K Ω internal series resistance)
	Sensitivity / Resolution	4.9 mV / 12 Bit
	Voltage Range	± 10 V

Connector		Control Specification
Encoder Equivalent Output (C4 by pinout)		
A/B/I & Complements (1, 2, 4, 5, 7, 8)	Output Voltage (high level) at 25° C	2.5 V min at 20 mA
	Output Voltage (low level) at 25° C	0.5 max at 20 mA
	RS 485 Line Drive Type	DS26C31TM
Remote Encoder Input (C5 by pinout)		
A/B/I & Complements (1, 2, 4, 5, 7, 8)	Input Voltage (high/low level) at 25° C	5 V / 0 V nominal (±.2 V)
	Input Impedance	100 Ω
	RS 232 Line Receiver Type	SN75173
See the section on Position Loop for features using this input. C5 requires Differential Input. For instructions using Single-ended Pulse, refer to Appendix .		
I/O Connector (C9 by pinout)		
Remote Motion Input (1, 2) SYS.DIN.1 Through SYS.DIN.4 Configurable Inputs(3, 4, 5) Configurable Inputs Common(1)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 to 24 V Nominal
	Min. On/Max. Off	10 V/1 V
	Current Demand per Input	20mA
Configurable Digital Outputs (6, 7) SYS.DOUT1, SYS.DOUT.2 Configurable Digital Output Common(8) *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=30V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA
I/O Connector (C10 by pinout)		
Configurable Inputs (2, 3, 4, 5) SYS.DIN.5 Through SYS.DIN.8 Configurable Inputs Common(1)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 to 24 V Nominal
	Min. On/Max. Off	10 V/1 V
	Current Demand per Input	20mA
Configurable Digital Outputs (6, 7) SYS.DOUT3, SYS.DOUT.4 Configurable Digital Output Common(8) *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=30V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA
I/O Connector (C11 by pinout)		
Configurable Inputs(2, 3, 4, 5) SYS.DIN.9 Through SYS.DIN.12 Configurable Inputs Common(1)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 to 24 V Nominal
	Min. On/Max. Off	10 V/1 V
	Current Demand per Input	20mA
Configurable Digital Outputs (6, 7) SYS.DOUT5, SYS.DOUT.6 Configurable Digital Output Common(8) *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=30V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA

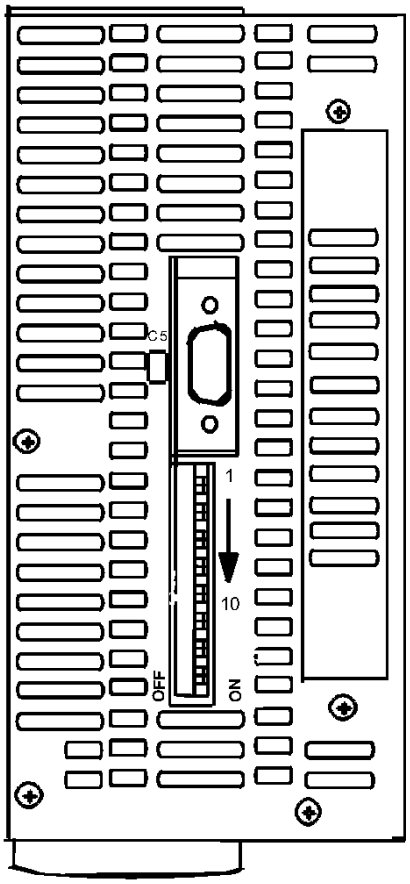
Connector		Control Specification
I/O Connector (C12 by pinout)		
Configurable Inputs (2, 3, 4, 5) SYS.DIN.13 Through SYS.DIN.16 Configurable Inputs Common(1)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 to 24 V Nominal
	Min. On/Max. Off	10 V/1 V
	Current Demand per Input	20mA
Configurable Digital Outputs (6, 7) SYS.DOUT7, SYS.DOUT.8 Configurable Digital Output Common(8) *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=30V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA
I/O Connector (C13 by pinout)		
Analog Input 2 (1, 2) ANIN2	Maximum Voltage	±12 V
	Input Resolution	AIN_2 - 14 bit
	Sensitivity	0.03 mV/bit
	Nominal Voltage	±10 V
	Input Impedence	10^{12} Ohms
Configurable Analog Output (3) ANOUT2, Configurable Analog Output Common (4) *All inductive loads require proper suppression*	Output Voltage	0 V to 10 V
	Max. Output Current	18 mA
	Sensitivity/ Resolution	4.9 mV/12 bit
24V Input (5, 7) Connector 7 is normally used. Connector 5 is used to string power supplies	Maximum Input Voltage	28V
	Minimum Input Voltage	20 V
	Current Consumption	1.1 A
24 V Return(6, 8) Connector 8 is normally used. Connector 6 is used to string power supplies		
I/O Connector (C14 by pinout)		
Configurable Inputs(2, 3, 4, 5) SYS.DIN.17 Through SYS.DIN.20 Configurable Inputs Common(1)	Input Frequency	2.5kHz (Opto-isolated)
	Input Voltage Range	12 to 24 V Nominal
	Min. On/Max. Off	10 V/1 V
	Current Demand per Input	20mA
Configurable Digital Outputs (6, 7) SYS.DOUT9, SYS.DOUT.10 Configurable Digital Output Common(8) *All inductive loads require proper suppression*	Output Voltage (max.)	V_{MAXON}=30V, V_{MAXOFF}=0.5 V
	(Min. On)	1 V
	Max. Output Current	60 mA

System Wiring Diagram

Overview



Front View

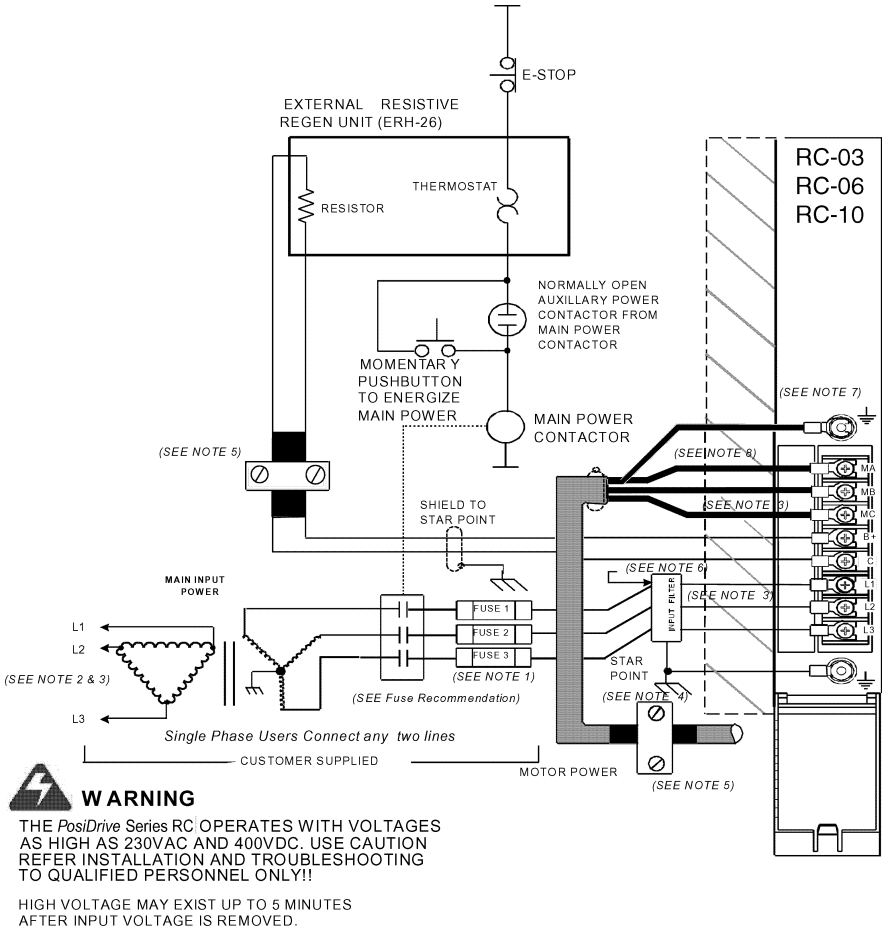


Top View

Units must be installed in an enclosure that meet the environmental IP rating of the end product (ventilation or cooling may be necessary to prevent enclosure ambient from exceeding 113° F (45° C).

Power

MAIN POWER



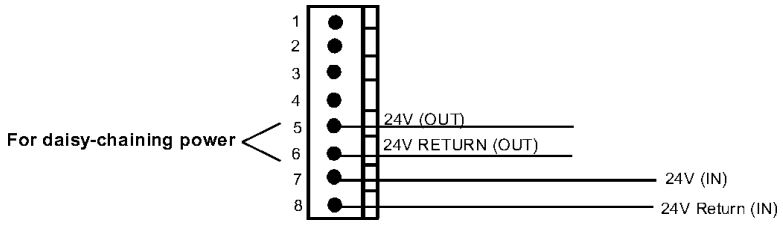
W ARNING

THE *PosiDrive* Series RC OPERATES WITH VOLTAGES AS HIGH AS 230VAC AND 400VDC. USE CAUTION REFER INSTALLATION AND TROUBLESHOOTING TO QUALIFIED PERSONNEL ONLY!!

HIGH VOLTAGE MAY EXIST UP TO 5 MINUTES AFTER INPUT VOLTAGE IS REMOVED.

LOGIC POWER

C13 Power Supply



Normally, you will use Pins 7 and 8. Pins 5 and 6 are used to daisy chain power. Pin 5 is internally connected to Pin 7. Pin 6 is internally connected to Pin 8.

POWER DIAGRAM NOTES

1 FUSE 2 and contactor may not be required if input power line is neutral. See Note 7.

2 Allow 30 seconds after turning power off before reapplying power

3 All AC Line wires should be twisted pair

4 The ground of the *PosiDrive RC* and motor best minimizes ground currents and noise when connected in a "star point" configuration

5 Cables should be properly bonded to the back panel and implemented as close to the *PosiDrive RC* side of the cable as possible for effective grounding. If bonding is installed, the shield on the cable end need not be connected to the "star point" configuration. Only connect the shield on one end of the cable, preferably on the *PosiDrive RC* side.

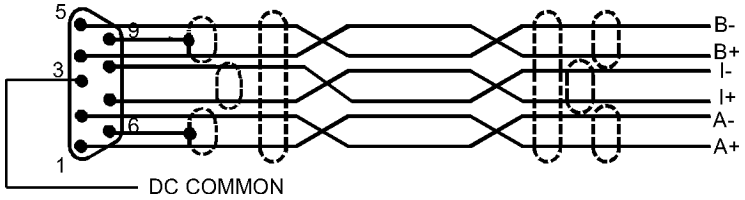
6 See CE Filtering Techniques for further information.

7 This system is suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical amperes, 240V maximum.

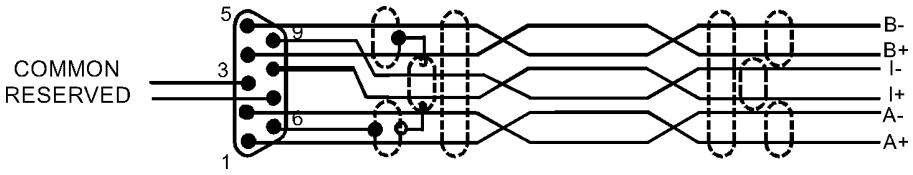
8 All inductive loads require proper suppression.

Encoder I/O

C4 Encoder Equivalent Output (D9P)



C5 Remote Encoder Input (Top of controller)



C5 requires Differential Input. For instructions using Single-ended Pulse, refer to Appendix A.

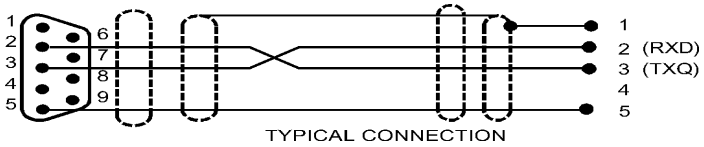
Communication

C6 – Ethernet Connector

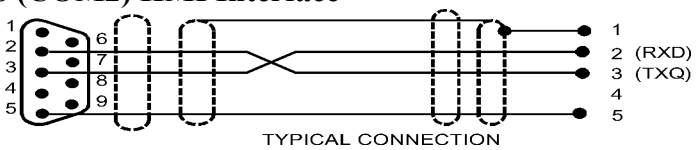
A standard "crossed" Ethernet cable must be used when connecting directly between the PC and *PosiDrive RC*.

If connecting the PC and *PosiDrive RC* via an Ethernet hub, an "uncrossed" Ethernet cable must used.

C7 (COM1) Serial Communication Interface*



C8 (COM2) HMI Interface*

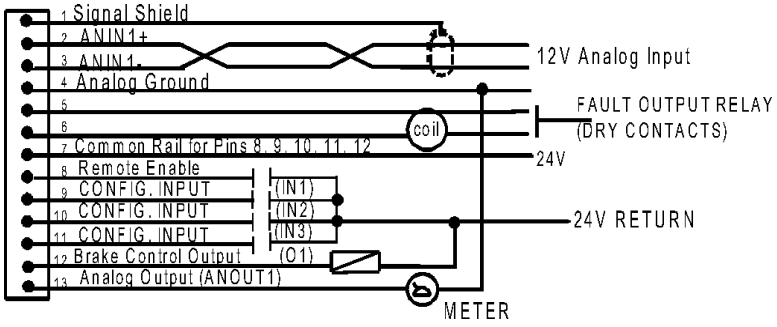


Do not connect unused pins on C7 and C8 connectors. Some manufacturers' cables connecting all pins may give unpredictable operation.

A standard "crossed" serial cable must be used when connecting directly between the PC and PosiDrive RC.

I/O Connectors

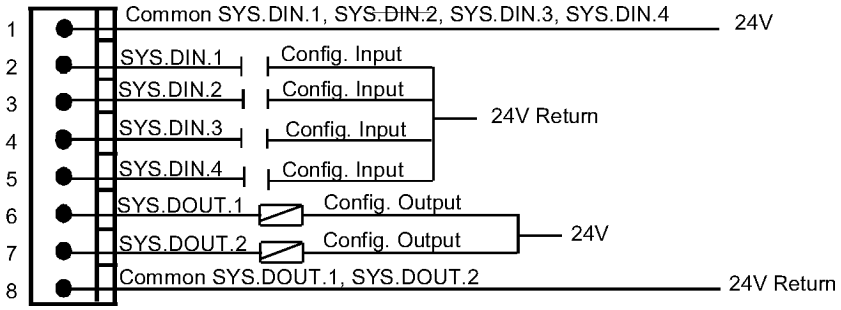
C3 Configurable I/O Interface



See the Electrical Specifications for loading information.

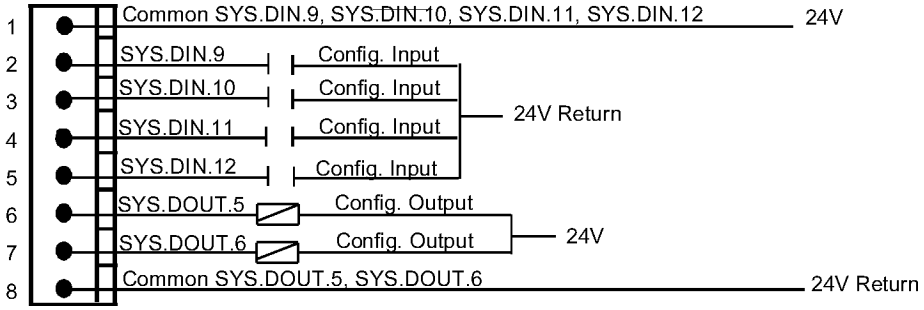
C9 Configurable User I/O

(Inputs can be sinking or sourcing – shown sourcing.)



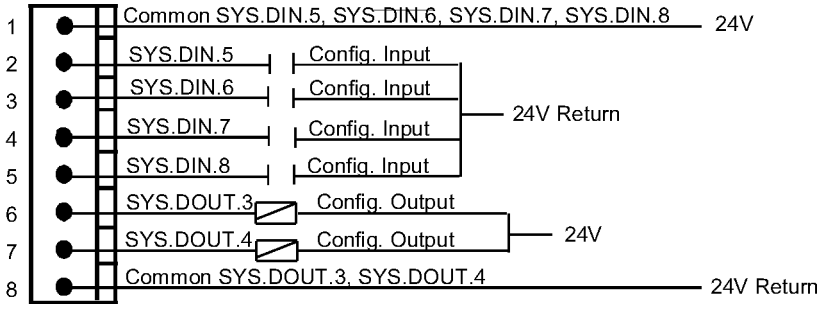
C10 Configurable User I/O

(Inputs can be sinking or sourcing – shown sourcing.)



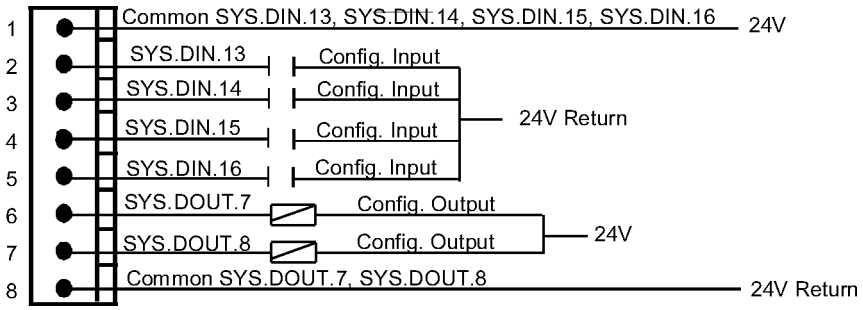
C11 Configurable User I/O

(Inputs can be sinking or sourcing – shown sourcing.)

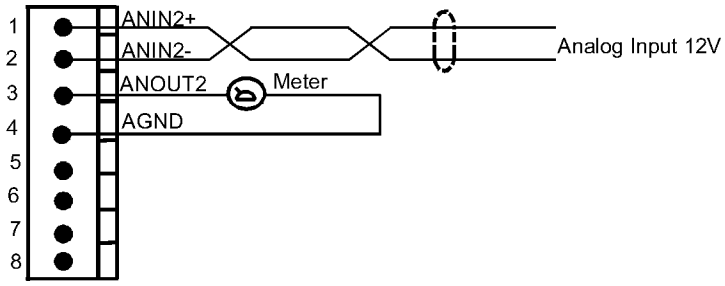


C12 Configurable User I/O

(Inputs can be sinking or sourcing – shown sourcing.)

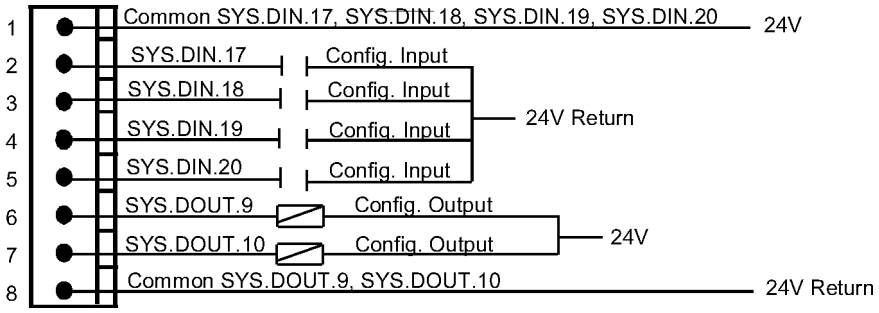


C13 User I/O (ANIN2)



C14 Configurable User I/O

(Inputs can be sinking or sourcing – shown sourcing.)



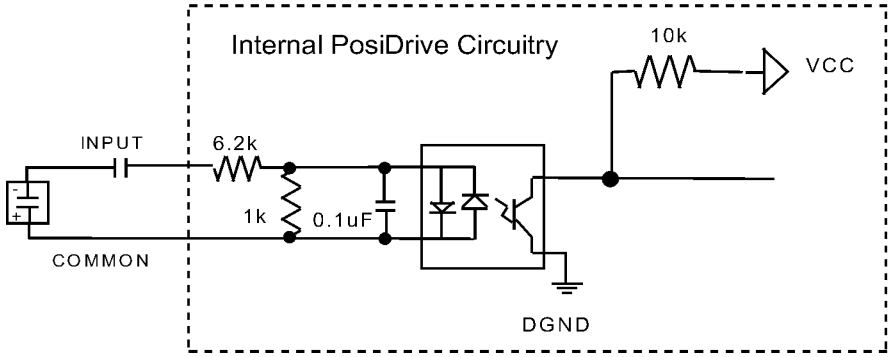
DIGITAL INPUTS

SOURCING OR SINKING

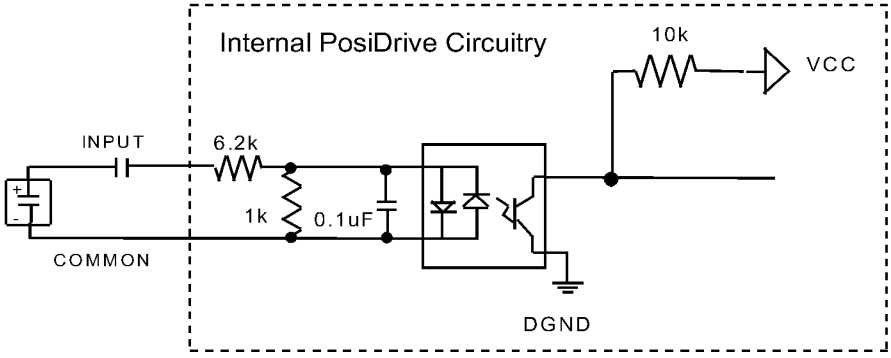
All DC inputs can be wired in a sinking our sourcing configuration.

All inputs on the same connector must use the same configuration.

SOURCING
EQUIVALENT DIGITAL INPUT CIRCUIT
FOR CONNECTORS C3, C9, C10, C11, C12, C14



ALTERNATIVE: SINKING
EQUIVALENT DIGITAL INPUT CIRCUIT
FOR CONNECTORS C3, C9, C10, C11, C12, C14



All inputs that share a common pin must be connected as either sinking or sourcing.

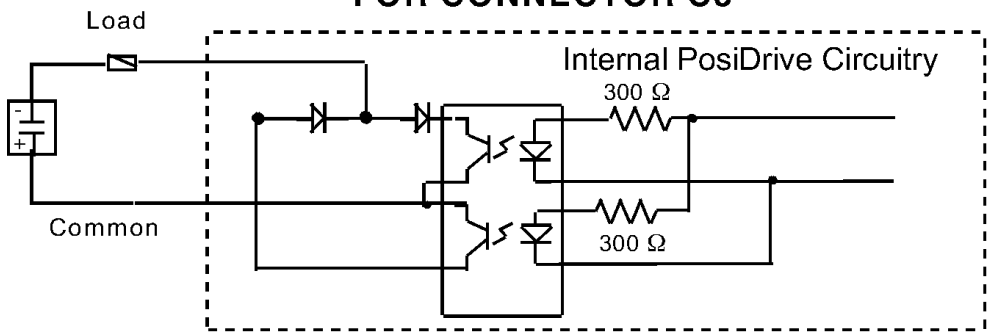
The input commons (C9 Pin 1, C10 Pin 1, C11 Pin 1, C12 Pin1, C14 Pin1) are not connected inside the PosiDrive. Likewise, the input and output commons for each connector (Pins 1 and 8) are not connected inside the PosiDrive on C3, C9, C10, C11, C12, and C14.

DIGITAL OUTPUTS

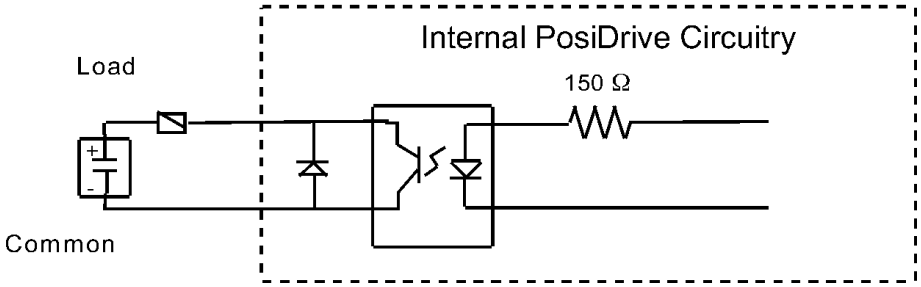
Connector C3 can only be wired in as sourcing.

Connectors C9, C10, C11, C12, and C14 can only be wired sinking.

SOURCING
EQUIVALENT DIGITAL OUTPUT CIRCUIT
FOR CONNECTOR C3



SINKING
EQUIVALENT DIGITAL OUTPUT CIRCUIT
FOR CONNECTORS C9, C10, C11, C12, C14



All inputs that share a common pin must be connected as either sinking or sourcing.

The output commons (C9 Pin 8, C10 Pin 8, C11 Pin 8, C12 Pin 8, C14 Pin 8) are also not connected inside the PosiDrive. Likewise, the input and output commons (Pins 1 and 8) are not connected inside the PosiDrive on C3, C9, C10, C11, C12, and C14.

DIP Switch Settings

DIP Switch		
Switch #	**Function**	**Settings**
1	Base Settings	Must be set to Open **(1)**
2		Must be set to Closed **(0)**
3		Must be set to Closed **(0)**
4		Must be set to Closed **(0)**
5		Must be set to Closed **(0)**
6	Configuration Bypass	0 = CONFIG.PRG or AUTOEXEC.PRG do not run on power-up 1 = **Default**
7	HOLD Mode Switch	0 = Hold Mode Inactive **(Default)** 1 = Hold Active
8	RC Enable/ Disable	0 = Enable **(Default)** 1 = Disable
9	Safe Upgrade	0 = Closed **(Default)** 1 = Loads backup firmware
10	Boot Diagnostic	0 = Closed **(Default)** 1 = Boot Diagnostic on power-up

The 10-position DIP switch is provided for diagnostic and setup purposes.

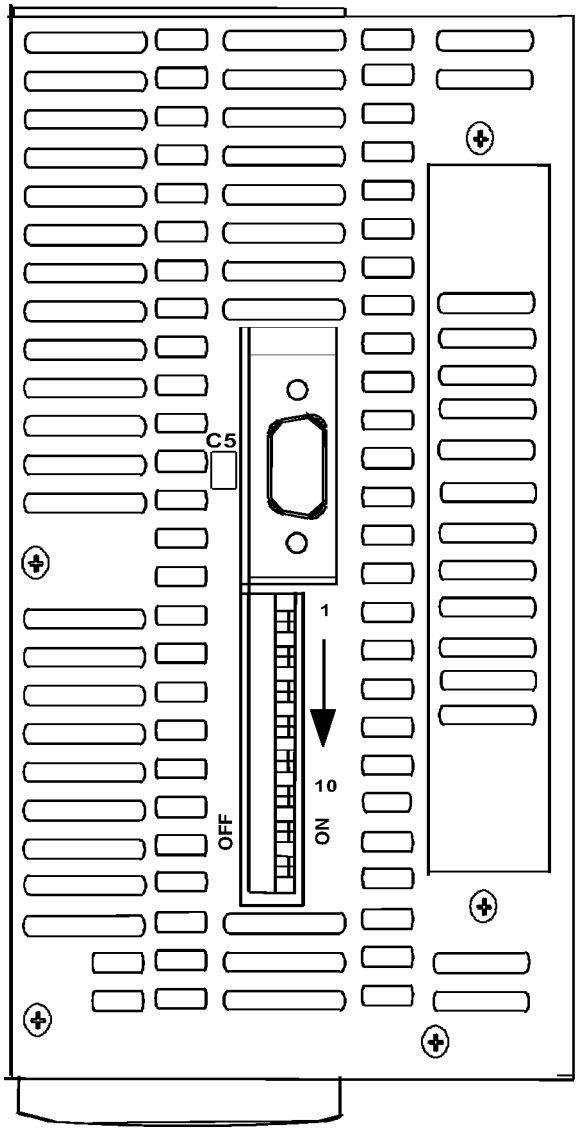
This switch provides the following functions:
Bypass: Activating switch 6 causes the drive to bypass configuration. CONFIG.PRG and AUTOEXEC.PRG do not run if this switch is closed.

Hold: Activating Switch 7 (normal state is closed) causes the *PosiDrive RC* to go into a hold state.

Disable: Activating Switch 8 (normal state is closed) disables the *PosiDrive RC*.

Safe Upgrade: Activating Switch 9 allows safe upgrades. The normal state is closed. The backup version of the firmware is loaded when this switch is open.

Boot diagnostics. If this switch is open, the controller prints diagnostic information over COM2 (C8).



Top View

DIP switches are in the "ON" or "Open" position when they are pushed to the right as you are looking from the front of the drive.

Feedback

For all other types of feedback motors, please contact Customer Support.

C2 Feedback Connector

Motor Frame Sizes: 070, 095, 115, 145 & 190			
Pin	Resolver	Encoder	Sine Encoder
1	Sine High	A	A
2	Sine Low	/A	/A
3	Shield	Shield	Shield
4	Cosine High	B	B
5	Cosine Low	/B	/B
6	Shield	Shield	Shield
7		E5V Return	E5v Return
8		E5V Return	E5V Return
9		H1B	H1B or C or Data*
10		H2B	H2B or D or Clock*
11		H3B	H3b
12	Shield	Shield	Shield
13	Thermostat High	Thermostat High	Thermostat High
14	Shield	Shield	Shield
15	Ref. High Out	Index	Index
16	Ref. Low Out	/Index	/Index
17	Shield	Shield	Shield
18		E5V Supply	E5V Supply
19		E5V Supply	E5V Supply
20		E5V Supply	E5V Supply
21	Shield	Shield	Shield
22		H1A	H1A or C or Data*
23		H2A	H2A or D or Clock*
24		H3A	H3A
25	Thermostat Low	Thermostat Low	Thermostat Low

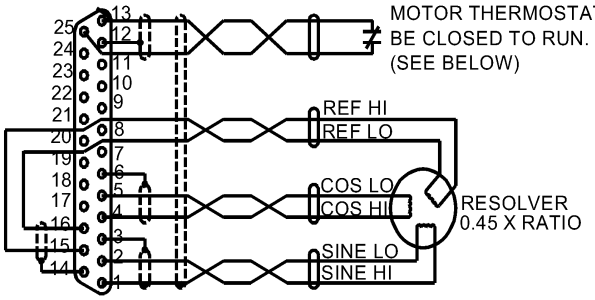
*The *PosiDrive RC* works with sine encoders with Halls feedback, sine encoders with C and D channels, and sine encoders with ENDAT RS45 serial channels.

Motor Frame Sizes: 060, 090, 130 & 175			
Pin	Resolver	Encoder	Sine Encoder
1	Sine High	A	A
2	Sine Low	/A	/A
3			
4	Cosine High	B	B
5	Cosine Low	/B	/B
6			
7		E5V Return	E5v Return
8		E5V Return	E5V Return
9		H1B	H1B or C or Data*
10		H2B	H2B or D or Clock*
11		H3B	H3b
12			
13	Thermostat High	Thermostat High	Thermostat High
14			
15	Ref. High Out	Index	Index
16	Ref. Low Out	/Index	/Index
17			
18		E5V Supply	E5V Supply
19		E5V Supply	E5V Supply
20		E5V Supply	E5V Supply
21			
22		H1A	H1A or C or Data*
23		H2A	H2A or D or Clock*
24		H3A	H3A
25	Thermostat Low	Thermostat Low	Thermostat Low

*The *PosiDrive RC* works with sine encoders with Halls feedback, sine encoders with C and D channels, and sine encoders with ENDAT RS45 serial channels.

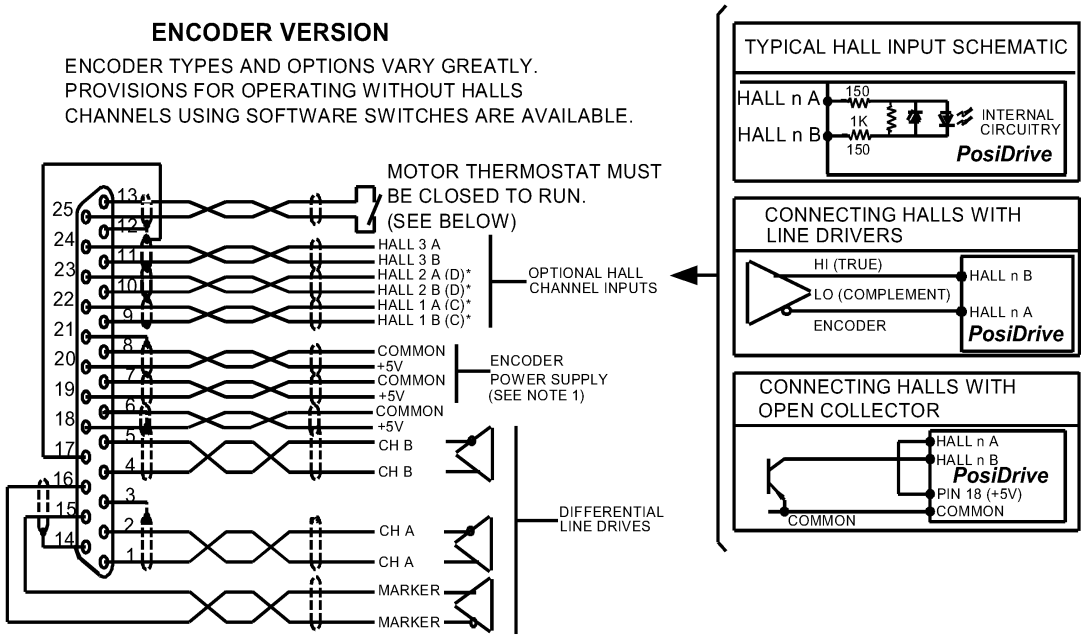
DIAGRAMS FOR MOTOR FRAME SIZES: 070, 095, 115, 145, 190

RESOLVER VERSION



ENCODER VERSION

ENCODER TYPES AND OPTIONS VARY GREATLY.
PROVISIONS FOR OPERATING WITHOUT HALLS
CHANNELS USING SOFTWARE SWITCHES ARE AVAILABLE.



NOTES:

THREE ENCODER SUPPLY CONNECTIONS ARE PROVIDED TO MINIMIZE VOLTAGE DROP IN CABLE. THE THREE ENCODER SUPPLY CONNECTIONS ARE HARD-WIRED TOGETHER INSIDE THE CONTROLLER. ONLY ONE SET NEED BE USED IN LOW CURRENT ENCODERS USING SHORT CABLE LENGTH.

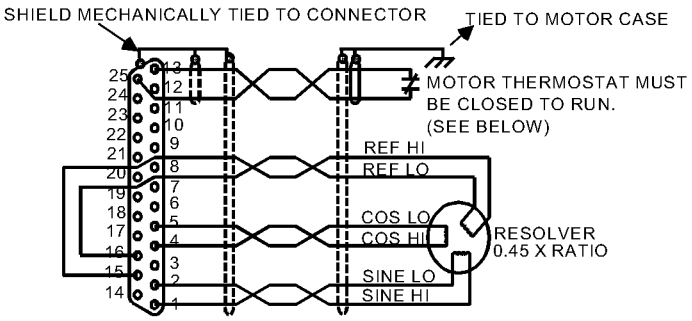
IF YOU HAVE OPEN COLLECTOR HALLS, TIE PINS 22, 23, & 24 TO +5v.

MOTOR OVERLOAD PROTECTION

MOTORS MUST HAVE INTEGRAL THERMAL PROTECTION OR EXTERNAL MOTOR OVERLOAD MUST BE USED.
THERMOSTAT SWITCH MAY SEE +12 VOLTS AND 20 MA.

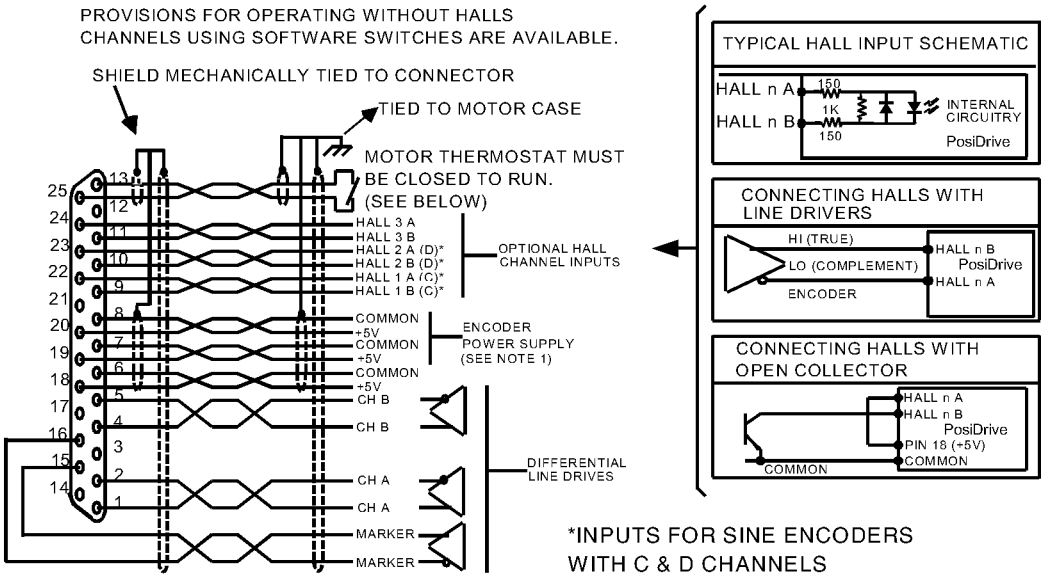
DIAGRAMS FOR MOTOR FRAME SIZES: 060, 090, 130, 175

RESOLVER VERSION



ENCODER/SINE ENCODER VERSION

ENCODER TYPES AND OPTIONS VARY GREATLY.
PROVISIONS FOR OPERATING WITHOUT HALLS
CHANNELS USING SOFTWARE SWITCHES ARE AVAILABLE.



*INPUTS FOR SINE ENCODERS WITH C & D CHANNELS

NOTES:

THREE ENCODER SUPPLY CONNECTIONS ARE PROVIDED TO MINIMIZE VOLTAGE DROP IN CABLE. THE THREE ENCODER SUPPLY CONNECTIONS ARE HARD-WIRED TOGETHER INSIDE THE CONTROLLER. ONLY ONE SET NEED BE USED IN LOW CURRENT ENCODERS USING SHORT CABLE LENGTH.

IF YOU HAVE OPEN COLLECTOR HALLS, TIE PINS 22, 23, & 24 TO +5v.

MOTOR OVERLOAD PROTECTION

MOTORS MUST HAVE INTEGRAL THERMAL PROTECTION OR EXTERNAL MOTOR OVERLOAD MUST BE USED.
THERMOSTAT SWITCH MAY SEE +12 VOLTS AND 20 MA.

Feedback Devices

For motor positioning and commutation, the *PosiDrive RC* can utilize a resolver, digital encoder (with or without hall-effect sensor signals), or sine encoder feedback. Force Control Industries, Inc. offers a variety of motors with options for these various feedback devices. The feedback requirements are diRCussed below.

Digital Encoder

The *PosiDrive RC* can use encoder feedback to monitor the motor shaft position. The encoder is an incremental device that indicates changes in position. The encoder resolution of the *PosiDrive RC* and the encoder equivalent output is fixed because it is a hardware characteristic of the encoder device.

The encoder interface includes three groups of wires:

1. A/B (and complements) lines make up the encoder quadrature signals. The signals are received differentially through line receivers before being passed through a wire-break detection circuit.
2. The narrow Index pulse normally appears once per revolution and indicates a known physical position of the shaft. This pulse is received differentially through a line receiver before being passed through a wire-break detection circuit. This signal is hardware capturable.
3. Hall-effect sensor signals provide information representing the approximate absolute location of the motor shaft. From this information, the motor can sinusoidally commutate forward until the index signal is detected - at which time true position is known. These signals are isolated by an opto-coupler and can be differential or open-collector type signals.

CABLE LENGTHS

The recommended cable length when using the *PosiDrive RC* to source the encoder is no longer than 50 feet (15 meters). Long encoder cables tend to have high DC resistance that may create significant loading effects in the supply lines to the encoder. An option that would allow the use of longer lengths, implements a separate supply located at the motor to source the encoder. Quadrature signals returned to the *PosiDrive RC* are differentially connected, which normally do not constitute a problem with longer cable lengths.

RESOLUTION AND ACCURACY

A *PosiDrive RC* encoder-based system typically exhibits minimal inaccuracies outside of the encoder itself. To get an approximate total value, the customer need only look to the specifications listed for the encoder being used.

Resolver

The *PosiDrive RC* uses either single- (two poles) or multi-speed (multiple poles) resolver feedback to monitor the motor shaft position. The resolver functions similar to a transformer whose output is unique for any given shaft position (an absolute position feedback). The transformer is driven with a sinewave reference signal. Two AC signals are returned from the resolver into the Sine and Cosine inputs. All three of these sinewave signals are low-level and suRCeptible to noise.

CABLE LENGTHS

It is important to use properly shielded cable and to keep it away from other noise-radiating devices and cables. Do not run the feedback and motor cables in the same conduit. Force Control Industries, Inc. has tested cable lengths up to 750 feet (229 meters) without degradation of performance. However, performance may vary depending on motor and resolver type. Tests were performed with standard Force Control Industries, Inc. cable and its low-impedance, Force Control Industries, Inc. ***PosiDrive*** motor resolver. Please consult factory for cable and resolver impedance specifications when long cable runs above 250 feet (76 meters) are desired. Force Control Industries, Inc. recommends twisted-shielded pair for feedback cables.

RESOLUTION AND ACCURACY

The *PosiDrive RC* calculates motor velocity as the derivative of position (change in position over time). With its patented technique, all readings are extended to a resolution of 16-bit. For velocity feedback calculations, the *PosiDrive RC* converts the resolver input to 18-bits of resolution giving smooth motor velocity control. The digital resolution (RDRES) of the Resolver-to-Digital Converter system is determined automatically according to the application velocity limit (VLIM). The following is a summary of the *PosiDrive RC*'s resolution capabilities:

VLIM (RPM)	RDRES	Counts/Rev	Encoder Eqv. Output (C4)
> 6100	12	4096	4096 quad counts
1500 to 6100	14	16384	16384 quad counts
< 1500	16	65536	65536 quad counts

R/D Converter Specifications

System accuracy using resolver feedback is affected by several components. The following table gives the user information on the inaccuracy that each of these components contribute to the total accuracy of a standard *PosiDrive RC* system:

Components	ArcMinutes
R/D Converter	4
Resolver mechanics (rotational)	8
Resolver mounting on motor shaft	2
Inter-LSB (digital dither over the least significant bit)	5
Total (Worse-case)	**19**

Resolver Accuracy Specifications

Sine Encoder

The *PosiDrive RC* can receive an analog (or sine) encoder feedback device to monitor the motor shaft position. As opposed to a digital encoder, which generates incremental square-wave signals, a sine encoder outputs analog differential sinusoidal signals. These sine signals are quadrature-decoded and passed to an interpolation circuit that breaks each 360° cycle into 256 parts before passing it to the drive's control board. Thus, the resolution seen by the drive is 256 times the fundamental sinusoidal track on the motor's encoder. The advantage of this approach is the ability to achieve high encoder resolution while maintaining a relatively low input frequency through the cable and into the *PosiDrive RC*. The encoder interface includes three groups of wires:

1. A/B (and complements) lines make up the encoder quadrature signals. The signals are received differentially at 1V peak-to-peak amplitudes before being processed by the interpolation circuitry.
2. The narrow Index pulse normally appears once per mechanical revolution and indicates a known physical position of the shaft. This pulse is received differentially through an op amp before being squared up and sent to the control board.
3. Upon power up, commutation signals are used to communicate coarse position information. The first three signal types give approximate position information so the drive can commutate the motor forward until the Index pulse is found. (There are situations where the index signal is not available. Course position information is used to commutate the motor indefinitely.) The fourth gives absolute information bypassing the need for the Index signal. They are:
   - There are no Hall signals if there are no power-up commutation signals available. The *PosiDrive RC* can excite two phases and lock the shaft in place. It then approximates the position of the locked shaft and uses only the incremental signals to commutate forward until the index is found.
   - Hall signals provide information representing the approximate location of the motor shaft (6 transitions per electrical cycle of the motor). From this information, the motor can six-step commutate forward until the index signal is detected, at which time true position is known and sinusoidal commutation begins. These signals are isolated by an opto-coupler and can be differential or open-collector type signals.
   - C/D lines are an alternative to Hall signals. These lines provide a SIN/COS sinusoidal signal where one electrical cycle equals one mechanical revolution (identical to single-speed resolver feedback). Interpolation is performed on these signals and absolute position is known within 256 parts of a mechanical revolution. The motor can commutate forward until the Index signal is detected.
   - Sine encoders with Endat capability add another approach to communicating commutation position. Here, absolute position information is stored in the encoder and is serially communicated to the drive upon power up. The data is received synchronously by a clock signal provided by the drive. Absolute position is known immediately;so an index signal is not needed.

CABLE LENGTHS

The recommended cable length when using the *PosiDrive RC* to source the sine encoder is no longer than 50 ft. (15 m.). Long encoder cables tend to have high DC resistance that may create significant loading affects in the supply lines to the encoder. Consider this carefully when designing the system. An option that would allow the use of longer lengths would be to put a separate supply at the motor to source the encoder. Except for noise suRCeptibility, signals returned to the drive are differentially connected, which normally do not constitute a problem with longer cable lengths.

RESOLUTION AND ACCURACY

Internal resolution of the system can be derived through the following calculation:

Encoder line resolution x 256 x 4 (quadrature).

System accuracy is largely dependent upon the accuracy of the encoder itself. To get an approximate total value, the customer need only look to the specifications listed for the encoder being used.

Filtering

CE Filtering Techniques

The *PosiDrive RC* system (*PosiDrive RC* and motor) meets the CE Mark standards stated in the front of this manual. Apply proper bonding and grounding techniques, deRCribed earlier in this section, when incorporating EMC noise filtering components to meet this standard.

Noise currents often occur in two types. The first is conducted emissions passed through ground loops. The quality of the system-grounding RCheme inversely determines the noise amplitudes in the lines. These conducted emissions are of a common-mode nature from line-to-neutral (ground). The second is radiated high-frequency emissions that are usually capacitively coupled from line-to-line and are differential in nature.

To properly mount the filters, the enclosure should have an unpainted metallic surface. This allows for more surface area to be in contact with the filter housing and provide a lower impedance path between the housing and the back plane. The back panel should have a high frequency ground strap connection to the enclosure frame and earth ground.

Input Power Filtering

The Force Control Industries, Inc. *PosiDrive RC* electronic system components require EMI filtering in the input power leads to meet the conducted emission requirements for the industrial environment. This filtering blocks conducted-type emissions from exiting onto the power lines and provides a barrier for power line EMI.

Adequately size the system. The type of filter must be based on the voltage and current rating of the system and whether the incoming line is single- or three-phase. One input line filter may be used for multi-axis control applications. These filters should be mounted as close to the incoming power as possible so noise is not capacitively coupled into other signal leads and cables. Take care when routing wires from the load side of the filter to the BUS Module. These lines may be noisy and should be separated from other sensitive cabling to avoid unwanted coupling of noise. Several manufacturers of these filters are listed below. They should be able to recommend the best filter design for most typical motor control applications. Force Control Industries, Inc. has also provided specific filter recommendations that will adequately attenuate the conducted noise to levels well below the CE limits. The implementation of the EMI filter should be done in accordance with the following guidelines:

- Filter should be mounted as close as possible to incoming cabinet power.
- When mounting the filter to the panel, remove any paint or material covering. Use an unpainted metallic back panel, if possible.

- Filters are provided with an earth connection. All ground connections should be tied to ground.
- Filters can produce high leakage currents. Filters must be earthed before connecting the supply!
- Do not touch filters for a period of 10 seconds after removing the power supply.

Control Type	Recommended EMI Line Filter	Force Control Industries, Inc. Part #
single phase 3 and 6 amps	Filter Concepts SF15	
3 phase 3 amp	Shaffner FN 258-7/07	
3 phase 6 and 10 amps	Shaffner FN258-16/07	

Recommended Line Filters

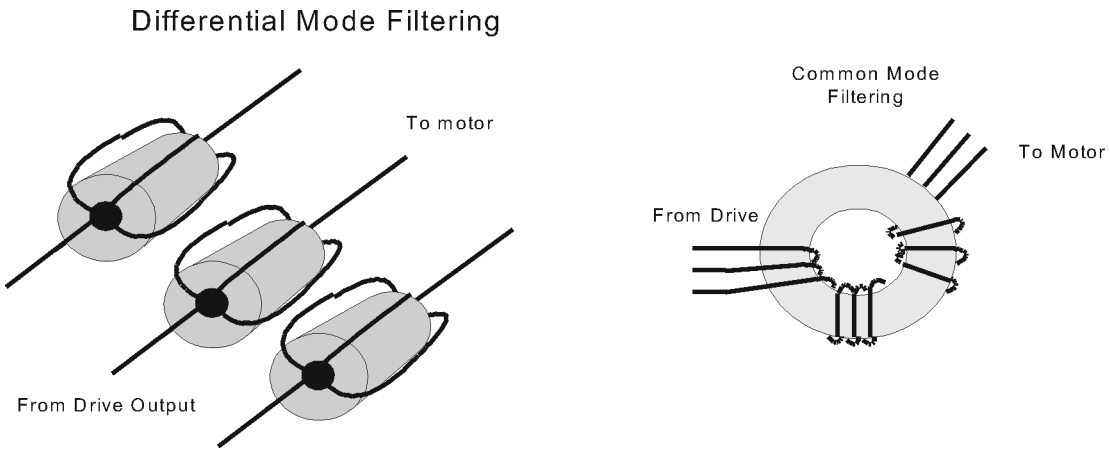
Motor Line Filtering

Motor filtering may not be necessary for CE compliance of *PosiDrive RC* systems. However, this additional filtering increases the reliability of the system. Poor non-metallic enclosure surfaces and lengthy, unbonded (or unshielded) motor cables that couple noise line-to-line (differential) are some of the factors that may lead to the necessity of motor lead filtering.

Motor lead noise is either common-mode or differential. The common-mode conducted currents occur between each motor lead and ground (line-to-neutral). Differential radiated currents exist from one motor lead to another (line-to-line). The filtering of the lines feeding the motor provides additional attenuation of noise currents that may enter surrounding cables and equipment I/O ports in close proximity.

Differential mode currents commonly occur with lengthy motor cables. As the cable length increases, so does its capacitance and ability to couple noise from line-to-line. While every final system is different and every application of the product causes a slightly different emission profile, it may become necessary to use differential mode chokes to provide additional noise attenuation to minimize the radiated emissions. The use of a ferrite core placed at the *PosiDrive RC* end on each motor lead (shown in the diagram below), attenuates differential mode noise and lowers frequency (30 to 60 MHz) broadband emissions to within specifications. Force Control Industries, Inc. recommends a Fair-Rite P/N 263665702 (or equivalent) ferrite core. Wrap each motor lead through the core several times as shown in the figure on the next page.

Never wrap a ground lead through a core.



Common mode currents occur from noise spikes created by the PWM switching frequency of the *PosiDrive RC*. The use of a ferrite or iron-powder core toroid places common mode impedance in the line between the motor and the *PosiDrive RC*. The use of a common mode choke on the motor leads may increase signal integrity of encoder outputs and associated I/O signals. A list of toroidal and ferrite cores that can be used to make common mode chokes is found in the following tables.

Manufacturer	***Manufacturer's Part #***	***Size***		
Micrometals	T400-26D	OD 4 in (102mm)	ID 2.25in (57.2mm)	HT 1.3in (33mm)
Micrometals	ST102-267	OD 1.025 in (26mm)	ID .6 in (15.2mm)	HT .475 in (12.1mm)
Micrometals	ST150-275B	OD 1.52 in (38.6mm)	ID ..835 in (21.2mm)	HT .825 in (21mm)
Micrometals	ST200-275B	OD 2.01 in (51.1mm)	ID 1.24 in (31.5mm)	HT 1.025 in (26mm)
Magnetics	77930-A7	OD 1.09 in (27.7mm)	ID .555in (14.1mm)	HT .472 in (11.99mm)
Fair-Rite	2643803802	OD 2.3 in (61mm)	ID 1.4in (35.55mm)	HT .5in (12.7mm)

Toroidal Core Recommendations

Manufacturer	***Manufacturer's Part #***	***Force Control Industries, Inc. Part #***	***DeRCription***
RChaffner	RD7137-36-0m5		500µH 3 phase common mode choke. 36 amps continuous.
RChaffner	RD8137-64-0m5		500µH 3 phase common mode choke. 64 amps continuous.

Pre-wound Common-Mode Chokes

I/O Filtering

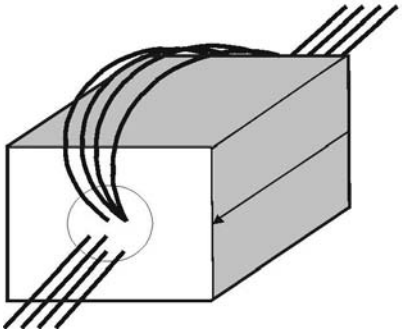
I/O filtering may be desired, depending on system installation, application, and integration with other equipment. It may be necessary to place ferrite cores on I/O lines to avoid unwanted signals entering and disturbing the *PosiDrive RC* system or other associated equipment. The following chart lists some ferrite parts that may be used for I/O filtering and noise attenuation. These parts are ideal for providing in-line common mode impedance for I/O lines (Fair-Rite Products Corporation has a varied selection, which suits most applications).

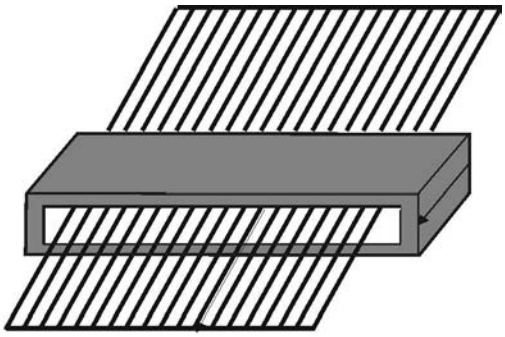
Manufacturer	*Manufacturer's Part #*	*Force Control Industries, Inc. Part #*	*DeRCription*
Ferrishield	SS33B2032		Clamp on core
Ferrishield	SS33B2036		Clamp on core
Ferrishield	FA28B2480		Clamp on core - flat cable clamp
Ferrishield	SA28B4340		Clamp on core - flat cable clamp
* Fair-Rite	2643167251		

* This core must be used with the *PosiDrive RC* for CE compliance. It should be applied to the 24V input power lines and the Remote Enable lines (7&8 on C3 connector) with approximately 3 turns through the core.

I/O Filter Recommendations

The following figure illustrates the use of multiple turns through a clamp-on core. The more turns created, the more impedance is added to the line. Avoid putting the shield in a clamp-on core. It is undesirable to place an impedance in-line with the shield. The use of ribbon cable may be common in many cabinets. Some ferrite clamps are designed just for ribbon cable use as shown below.

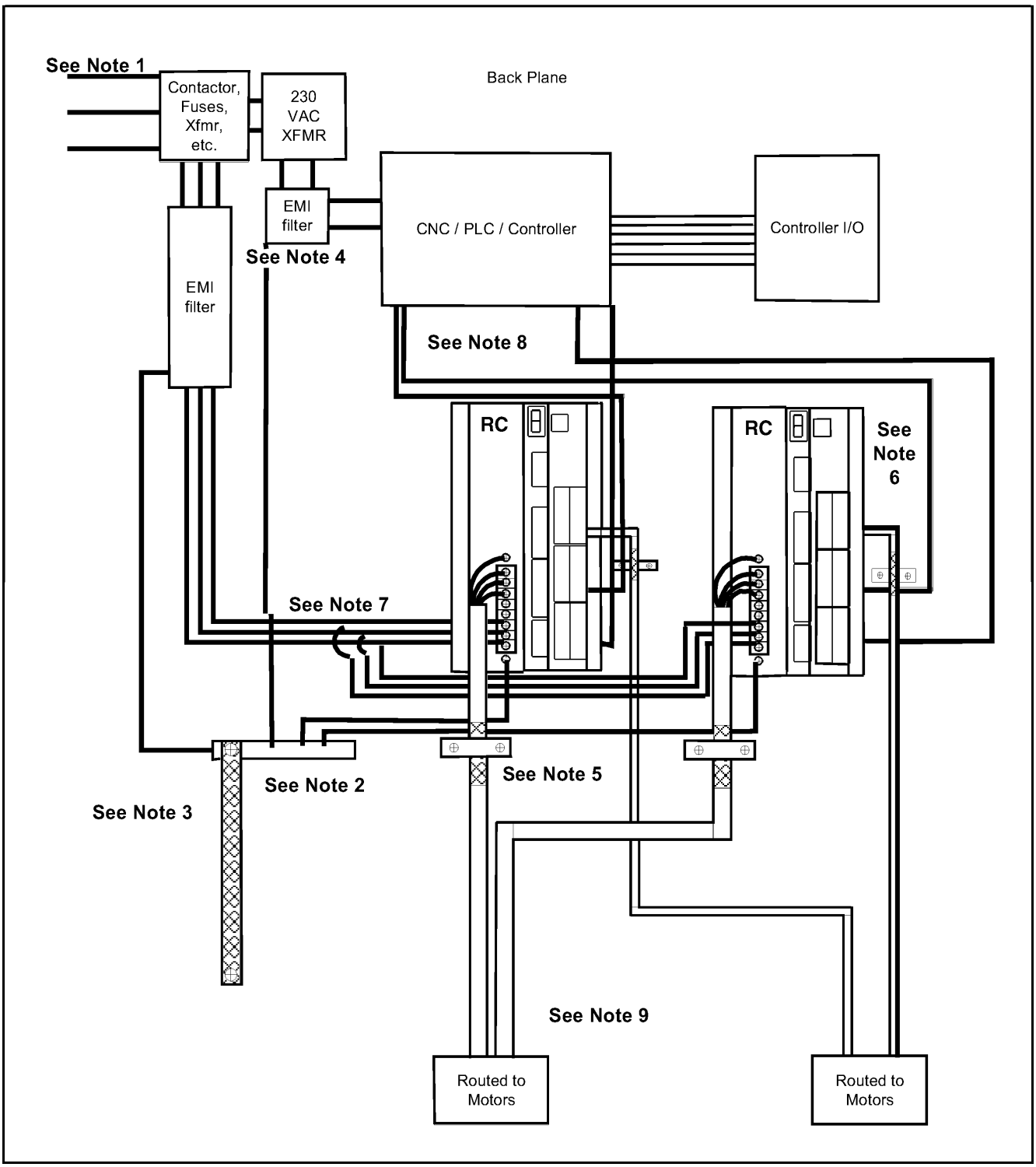




Flat cable clamp used with ribbon cable

I/O Filtering Techniques

Filter and Bonding Diagram



FILTER/BONDING DIAGRAM NOTES

Note 1 Input power - Enters enclosure from metal conduit.

Note 2 Single point ground. A bus bar (ground bus) is an excellent way to achieve this.

Note 3 High frequency ground between conductive back panel and enclosure. Also, a high frequency ground is required between the enclosure and earth ground.

Note 4 EMI filter grounding. Safety grounds must be provided on the filters. Potentials can exist even when the power is off because of the capacitors internal to the filters.

Note 5 Bonding of motor cables. The use of armored (RCreened) motor cables that are bonded as close to the *PosiDrive RC* as possible are essential for CE compliance and strongly recommended to better the overall performance and reliability of the system.

Note 6 Feedback cable bonding is required for CE compliance. As with the motor cables, the feedback cables should be bonded to the back panel. This bonding will do two things. First it will cut down radiation from the *PosiDrive RC*. This radiation may be in the form of high frequency energy resulting from internal processor clocks. The second thing this bonding effort provides is immunity for the *PosiDrive RC*. Since the feedback device is located internal to the motor it is going to pick up some noise currents and transmit them along the feedback cable. The bonding will direct the currents from the shield of the feedback cable to back panel ground. This will reduce the amount of noise entering the *PosiDrive RC*.

Note 7 AC power lines that must be routed past other lines (such as motor cables or I/O lines) should cross at a 90-degree angle. This will minimize the coupling effect. Additionally, the power lines should be routed as close to the back panel as possible. Any noise currents on the lines may then be capacitively coupled to the ground plane and not to other lines.

Note 8 Control (I/O) signals should be kept separate from all power and motor cables if possible. Keep control wiring as short as possible and use RCreened wire. Bonding is also recommended but not required for CE compliance. Separation distance of 20-cm (8-in) should be sufficient in most cases. Where control cables must cross power cables, they should cross with an angle of 90°.

Note 9 Motor cables and feedback cables exiting the cabinet going to the motor should be separated as much as possible. Ideally, using separate conduits provides good isolation that limits coupling of noise from motor to feedback cables.

CONTROLLER OPERATION

Status Display

The *PosiDrive RC* has a seven-segment indicator (called a Status Display) that indicates four types of states: Power-up, Steady State, Flashing State, and Momentary State. The decimal point directly relates to the global *PosiDrive RC* enable.

Status Display	
***PosiDrive* STATE**	**DISPLAY APPEARANCE**
Power-up	Momentarily lights all display segments (forming an 8), the decimal point and then "0" intermittently for several seconds before flashing "S".
Steady State (No Faults)	Displays the operational mode (OPMODE). Displays "8" for digital position mode, "0" for digital velocity mode.
Flashing State	Used to indicate an abnormal operating state: If a fault was detected, a flashing code will be displayed to identify the fault. Some codes consist of a sequence of two or more digits (see Troubleshooting section). In general, these faults will cause a latched disable (sometimes controllable through software switches). To clear fault, toggle SYS.MOTION or Remote motion input (except for OverCurrent). If the encoder initialization function (ENCSTART) is active, the OPMODE number will flash at a 3 Hz rate.
Momentary Fault	Displays a flashing character. C1 = Synchronization Error between Control and Positioner boards. May happen due to extremely high CPU load. C2 = Positioner fault (SYS.MOTION = 0). Indicates that SYS.MOTION is zero. Happens in the following situations: 1. Motion input is inactive (check state of SYS.DIN.1) 2. Unhandled application error (check Sys.Error and ErrorHistory) 3. Servo Error (check ServoEror) When all the error situations (reasons) are cleared, set SYS.MOTION to "1" either by toggling Motion input or typing SYS.MOTION=1 in the terminal window.

Status Display Decimal Point	
DECIMAL POINT STATE	***PosiDrive RC* STATUS**
Steady OFF	No power to the motor
Steady ON	*PosiDrive RC* enabled, power to the motor
Flashing	*PosiDrive RC* enabled, power to the motor, but a motor safety feature has been disabled (for example, LIMDIS = 1).

Understanding Conmodes

The ***PosiDrive*** has only two Conmodes. Conmode one is where an “S” is displayed and compensates for a particular motor or changing a motor parameter. Conmode two is where an “8” or “0” is displayed and changes all other parameters, enabling the drive and performing motion.

A Conmode is changed in the Software main RCreen by the drop-down menu, "Conmode" or at the Terminal RCreen by typing either “sys.conmode = 1” or “sys.conmode = 2”. If sys.conmode=0, you will encounter a C2 error.

Operational Modes

The *PosiDrive RC* has the ability to assume different modes of operation. It is factory configured in OPMODE1 (Analog Velocity Controller) but may be reconfigured by the user. Not all commands and variables are active or meaningful in every OPMODE.

OPMODE 0 **Digital Velocity Controller.** The *PosiDrive RC* is configured as a velocity-loop controller and is controlled by issuing a velocity command (JOG: jog command).

OPMODE 1 **Analog Velocity Controller**. The *PosiDrive RC* is configured as a velocity-loop controller and is controlled through either a ± 10V analog input signal. The commanded velocity is proportional to the input voltage by the AnalogVelocityRCale factor.

OPMODE 8 **Position Controller - Digital Position Mode**. The *PosiDrive RC* is configured as a digital positioning controller. This is the default mode, but can also be caused by issuing a Move command.

System I/O

This section diRCusses the I/O features of the C3 connector (except for the Thermostat input on C2). Analog Input (ANIN1, ANIN2) the position, velocity, or torque loop can receive its command from an analog voltage source and is selectable through the OPMODE variable. The analog input to the ***PosiDrive*** is differential (signals received at the two inputs are subtracted from each other to create a ‘difference’ used to command the rest of the system). This type of input has a high degree of noise immunity and, in many cases, allows for ground isolation between systems. This analog input also has a low pass filter (ANLPFHZ1, ANLPFHZ2) to prevent high frequency noise from entering the system. The input voltage from the differential receiver is applied to a precise 14-bit Analog-to-Digital (A/D) conversion system. The A/D conversion system is read by the microprocessor every 500µS for the position loop modes, every 250µS for the velocity loop mode, and every 62.5µS for the torque (current) loop mode of operation.

Encoder-based units come with the additional benefit of a Dual Gain (ANDG1, ANDG2) input. When enabled, the system uses two 14-bit A/D inputs to read the user-supplied analog signal. One input is a direct reading of the ± 10V signal; while the other incorporates a 2x gain term. When the input voltage is less than 4V, the 2x channel is used to determine the input voltage, extending the resolution to a 15-bit equivalent. Above 4V, the system uses the straight 14-bit conversion. Special software algorithms are used to minimize crossover distortion and add .25V of hysteresis.

Analog systems often require RCaling and offset bias. The *PosiDrive RC* adds an analog offset (ANOFF1, ANOFF2) variable to this reading, performs an analog deadband (ANDB1, ANDB2) adjustment, and RCales it through the position loop input RCaling, velocity loop input RCaling (VRCALE), or torque loop input RCaling (IRCALE) before passing the data to the selected control loop. The analog input (ANIN) variable indicates the analog reading after the offset (ANOFF1, ANOFF2) and the deadband (ANDB) adjustments but before the loop RCaling. The ANIN variable range is ± 22500 counts or mV.

The *PosiDrive RC* offers an automatic analog input zeroing function. Invoking either the ANZERO1 or ANZERO2 command while the *PosiDrive RC* is enabled or disabled samples motor velocity over a 32-mSec period and updates ANOFF accordingly to cancel out analog input offset. This command also incorporates an internal offset mechanism with finer resolution than ANOFF is capable of providing.

Remote Enable Input (REMOTE)

The opto-isolated Remote Enable input (REMOTE) provides a hardware enable switch. This 12 to 24 VDC input disables or enables the power stage output to the motor. The signal must be customer-supplied to get the ***PosiDrive*** to enable (in combination with other parameters) ACTIVE and operate. Do not tap the signal off the logic supply (C5). The ***PosiDrive*** cannot be enabled just with Remote Enable, software enable (EN=1) is required. However, once ***PosiDrive*** is enabled user can disable or enable with Remote enable.

Configurable Inputs (IN1, IN2, IN3)

These 12 to 24 VDC inputs are defined by the INxMODE variable (IN1MODE, IN2MODE, IN3MODE). Placing the appropriate value in INxMODE sets up the inputs to be used for such features as CC/CCW (clockwise/counter-clockwise) hardware position limits homing and more. When set for the CC/CCW hardware position limits, the inputs prevent any further motor travel in their respective direction but do not disable the ***PosiDrive*** or prevent motion in the opposite direction. These inputs are opto-isolated and considered "active enable" (current must flow through these signals to allow the system to operate). This provides a feature to reduce the possibility of personal injury. Energizing both the CW and CCW hardware position limits causes the ***PosiDrive*** to enter the HOLD mode.

The default settings of these inputs are for the hardware position limits. The Status Display flashes an 'L' upon power-up, indicating that a travel limit has been tripped. If these position limits are not in use, set LIMDIS=1.

Configurable Analog Outputs (ANOUT1 & ANOUT2, O1)

The ±10V, 12-bit analog outputs (ANOUT1 and ANOUT2) are used only for monitoring. The setting of this variable allows you to meter various feedback quantities such as velocity, current, horse power, position feedback, following error, and more. This pin is referenced to DC Common (pin 4). The digital output (O1, O1MODE) is toggled in an On/Off state to indicate enable/disable and used for motor braking. All inductive loads require proper suppression.

Configurable Digital I/O (C9, C10, C11, C12, C14)

The configurable digital I/O can be accessed from a task or command line with the commands, SYS.DIN or SYS.DOUT. Both inputs and outputs may be bit- or group-addressed. Users can also use digital inputs for asynchronous events.

Fault Output Relay (RELAY, RELAYMODE)

The *PosiDrive RC* provides a drive ready or drive up output in the form of a relay (RELAY) output. The relay (RELAY) output is controlled by the *PosiDrive RC*'s microprocessor. There is a software switch (RELAYMODE) that configures the relay (RELAY) output to act as a 'Drive Ready' or 'Drive Up' indicator:

RELAYMODE = 0	The relay is closed when the ***PosiDrive*** is error free and ready to run. This is a 'Drive Ready' configuration.
RELAYMODE = 1	The relay closes only when the ***PosiDrive*** is enabled. This is a 'Drive Up' configuration.
RELAYMODE = 2	The relay opens during a fault when the ***PosiDrive*** is disabled.

You can program this fault output to open on any system fault by triggering the Configurable Inputs (INxMODE, INx).

Motor Thermostat Input (THERM, THERMODE)

The *PosiDrive RC* provides a motor thermostat input on the C2 connector that can be configured for different types of thermal protections (THERMTYPE) as well as manipulation of how the *PosiDrive* responds to a motor thermal condition (THERM, THERMODE, THERMTIME). Force Control Industries, Inc. *PosiDrive* servo motors and cables connect the thermostat through the feedback cable. The input to the *PosiDrive RC* should be electrically closed through the thermostat for proper operation. The *PosiDrive* normally flashes an 'H' in the Status Display when this input is electrically opened.

If a motor thermal device is not used, THERMODE is set to '3' to disable the feature and turn the 'H' status display indicator off.

Core Processors

A 40 MHz embedded controller and a 40 MHz DSP controller are the heart of the *PosiDrive RC*. They use its internal operating system to monitor inputs, adjust outputs, communicate serially, maintain servo control, and monitor faults. The motion profile generation, programming and communication are handled by 100MHz x86 compatible embedded microprocessor, running real-time operating system. The flash memory firmware that controls the core processor and gives the *PosiDrive RC* its operating characteristics is saved in EEPROM. User programs are stored on Flash Disk (DiskOnChip). The version number of the firmware is read using the VER command. When calling for technical support, be sure to have the firmware version number readily available. The most recent version of firmware is available for purchase and is easily field-upgradeable through a PC.

Control Loops

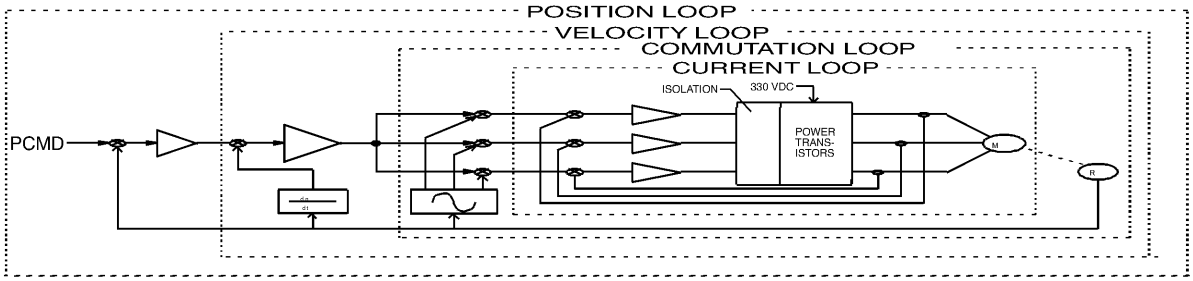
This section deRCribes the servo control loops, their characteristics, and how to configure them.

Servo Loop DeRCription

The *PosiDrive RC* provides high performance motor control by controlling up to four distinct closed loop systems within the DSP:

- current
- commutation
- velocity
- position

The figure below depicts the control loops graphically.



Control Loop Structure

CURRENT LOOP

Since current and torque are proportional in a Permanent Magnet (PM) motor, the current loop is often referred to as the torque loop. The function of the current loop is to regulate motor current as directed by a current command signal. The current command signal from the microprocessor comes either from a direct user input (OPMODE 0) or from the output of the velocity loop. There are actually three current loops, one for each motor phase. Each current loop receives its own command input from the commutation loop.

The *PosiDrive RC* uses a fully digital, pole placement current loop with high bandwidth and a current loop sampling rate of 16 kHz (62.5 µS). All coefficients of the current loop are digitally calculated inside the ***PosiDrive*** for a given set of motor and ***PosiDrive*** characteristics. The current loop also includes adaptive gain terms to compensate for some non-linear effects.

The current loop incorporates electrical isolation for protection from the high-voltage BUS. These current loops also convert the output voltage to a Pulse Width Modulated (PWM) signal providing the highest efficiency possible. The PWM center frequency can be 8 or 16 kHz according to the ***PosiDrive*** size.

COMMUTATION LOOP

This loop converts a single-phase current command signal into a three-phase, position-modulated sine wave input to the current loops. The *PosiDrive RC* has a patented sinusoidal waveform generator, which uses a technique called Torque Angle Advance to get top performance out of its motors. The waveform generator is part of the microprocessor and is updated at a 16 kHz rate. This provides hi-fidelity sinewave commutation at both low and high velocities. The sinewave output is aligned to the back EMF characteristics of the motor, making resolver (or encoder) alignment to the motor critical.

VELOCITY LOOP

The purpose of the velocity loop is to regulate motor speed. Like the current and the commutation loops, the velocity loop is digital and uses the resolver or the encoder feedback signals to calculate actual motor velocity. The command for the velocity loop either come directly from user input (OPMODE 0 or 1) or the output of the position loop. The velocity loop is a digital sampling system operating at 4 kHz.

The difference between actual and desired velocity is filtered through a compensator algorithm and fed to the commutation loop. The *PosiDrive RC* offers four velocity compensators (methods of regulating velocity) and are selectable through the COMPMODE variable. The four are: Proportional-Integral (PI), Pseudo-Derivative-Feedback with Feed-Forward (PDFF), Standard Pole Placement, and Extended Standard Pole Placement.

POSITION LOOP

The final control configuration is the position loop. The purpose of this loop is to maintain motor shaft position. Like the previous loops, the position loop is digital and uses resolver, encoder, and sine encoder feedback signals to determine actual motor position. The ***PosiDrive*** also accepts a position signal from an external feedback device (e.g., load encoder). It samples at a rate of 2 kHz and can be configured for three different modes of operation:

1. Using a MOVE and HOME commands, the ***PosiDrive*** executes simple absolute, incremental (indexing), and homing motion profiles.

2. Homing types (HOMETYPE) are available that home to a particular analog input level and position count, triggering either through the configurable inputs or the remote enable.

In this mode of operation, the ***PosiDrive*** also accepts an external load feedback signal through the C8 connector (DUALFB=1). This helps eliminate the positional inaccuracies (due to gear backlash and poor coupling) by positioning according to the load's position, not the motor shaft's position.

3. The *PosiDrive RC* also operates in the position mode when the ***PosiDrive*** is in the hold position state.

Torque Loop Operation

The *PosiDrive RC* has many internal variables used to examine and dictate system operation. Many of these variables and their locations in the Software are presented graphically to enhance meanings and relationships.

CURRENT SAMPLING

The current loop receives corrective feedback from the current sampling circuitry. The current sensors use closed-loop hall sampling techniques in all units.

The current sample is used by the current loops to regulate the current in each of the three motor phases. Two phases (A and C) of the current signal are sampled by the microprocessor at a 16 kHz rate. The momentary A phase current and C phase current can be monitored by examining the IA and IC variables, respectively. The microprocessor calculates the equivalent absolute current, which is monitored as I.

Foldback

The *PosiDrive RC* offers two types of Foldback protection for both the motor and ***PosiDrive***. The ***PosiDrive***'s microprocessor monitors the current feedback signal and develops an RMS value of this signal for the purpose of providing a value that represents the current in the motor. The system is similar to an "I-squared-T accumulator.

DRIVE FOLDBACK

This Foldback algorithm monitors current feedback and, if the feedback exceeds the continuous current rating of the ***PosiDrive*** /motor combination (ICONT), decreases the system's current to the ICONT level. For example, under a step command input condition, the Foldback algorithm allows maximum peak current (IMAX) output from the ***PosiDrive*** for 2 seconds. After two seconds, the ***PosiDrive*** enters "Foldback mode" (FOLD =1) and begins an exponentially Foldback to the system's continuous current. It takes approximately six seconds for the exponential decay to drop from the system's peak current to its continuous level.

This Foldback feature is designed to protect the PosiDrive electronics, not the motor. The Configurable Output, O1, (pin 12) can be configured to indicate a PosiDrive Foldback condition.

For PosiDrive currents that exceed ICONT, but are below IMAX, the system period before Foldback occurs is extended beyond two seconds. Two seconds is the shortest time period that elapses before the PosiDrive enters Foldback and only occurs when maximum peak current (IMAX) is drawn.

MOTOR FOLDBACK

This Foldback algorithm is designed to provide motor protection in cases where the ***PosiDrive***'s continuous current rating is above the motor's continuous rating. This combination is often desired in applications where maximum peak motor torques are required. However, the ***PosiDrive*** could source current on a continuous basis indefinitely to the motor and would force it beyond its thermal capability. Unlike the ***PosiDrive*** Foldback, you have complete configurability over this feature (MFOLD, MFOLDD, MFOLDDIS, MFOLDR, MFOLDT).

TROUBLESHOOTING

Troubleshooting tools

Software comes with a Status RCreen (click on “Status” button in the upper right-hand corner of Main RCreen) containing complete error history information. This information can also be accessed in the terminal window by entering “?ErrorHistory”

Software Diagnostic Tools

The Drive I/O RCreen (click on “Drive I/O” button on the side of the Main RCreen) gives you the ability to check the status of the Drive I/O on Connector C3: You can also monitor a variety of variables from the Monitor RCreen (click “Monitor” button at the top of the Main RCreen) and compare up to three variables at one time. The Tune and Record RCreen allows you to evaluate the system’s actual performance against a predefined command profile. Also from this RCreen, you can vary the performance by adjusting the gains until optimum following is achieved.

BASIC Moves Software Diagnostic Tools.

In BASIC Moves Software, there is a terminal window that allows you to query the drive direction for values and obtain information on errors. Common Troubleshooting commands are:

?ErrorHistory – List all errors
?ServoError –List active servo error
?Sys.conmode and **?OpMOde** – List present operation mode
?TaskList – List status of task loaded in RAM
?EventList – List status of loaded Events

The Watch window allows you to display parameters realtime. This is an excellent tool to monitor key parameters, inputs and outputs throughout the operation of the program.

The Message Log displays program syntax errors and can be used to print information during program execution.

The Editor provides single-stepping, allowing you to execute single lines of the program.

The Task Manager Window (access from menu bar) shows the present status of each task, including the last executed line of the program (this number appears below the Source heading in the Task Manager Window).

Most Common Problems and Solutions

The table below contains a list of the most commonly encountered problems and suggests corrective actions for each problem.

Problem	Corrective Action
BASIC Moves gets hung up after "Select Device" RCreen. This is where RC shows up but after trying to connect, BASIC Moves (BM) hangs up	Close BASIC Moves. Power down drive. Change SW 6 to 0. Restart BM. If problem goes away, there may be a bug in Config.prg or Autoexec.prg tasks. Error in Autoexec.prg. Check ?ERRORHISTORY in terminal for error deRCription.
The Software locks up during operation	Close the software and delete KMTCPIP from the Windows Task Manager (access by Ctrl/Alt/Del). Restart the software
c1 Error	Internal System Error. To reset set sys.conmode = 1 then sys.conmode = 2.
c2 Error (Sys.motion flag turned off)	Check Motion HW Input (Sys.DIN.1) on connector C9. Check ?SERVOERROR in BASIC Moves terminal for error. Correct problem causing error. Check ?ERRORHISTORY in BASIC Moves terminal. Correct problem causing error. If running a program, verify the program did not change any properties designed to only be changed when drive is disabled. (Example: Sys.conmode). *After correcting problem the motion flag can be reset by toggling motion input (sys.din.1) on connector C9 pin 2 or entering sys.motion = 1 from the BASIC Moves Terminal.*
Cannot communication thru HMI port (connector C8)	

Problem	Corrective Action
Cannot communicate with Ethernet connection (connector C6)	Verify your computer's operating system and version number are supported (Example : Win 95 version 4.0 or later). If point-to-point connection, make sure you are using a "crossed" communication cable. Poll to see if used by another computer. If multiple RC users on a network, recommend keeping IP Pool on Network and all users use the same IP Pool. Verify LAN supports 10Mbits communication and not just 100Mbits. Make sure addresses in IP Pool have been created. Make sure addresses and subnet mask in IP pool and Host computer's IP work together. (If communicating via network review addresses with network administrator). To verify hardware connection. "ping" the RC's address through the Start menu (Start/Run then enter on the command line "Ping <*drives address*>").

Problem	Corrective Action
Cannot communicate with Serial connection (connector C7)	Verify your computer's operating system and version number are supported (Example: Win 95 version 4.0 or later). Make sure you are using a crossed cable (containing only pins 2,3, and 5). Check Serial Port Parameters. 38400 8 Data bits No parity 1 Stop bit Verify no flow control Check SLIP connection is set up (Not PPP). Check SLIP set-up parameters: IP Address on computer set to 91.0.0.1 (*PosiDrive RC*'s IP address is fixed at 91.0.0.2). Uncheck IP header compression. Uncheck "default gateway on remote network" if checked. In NT, package size must be 1006. Make sure you are connected to C7 and right serial port in the PC.
Cannot Enable Drive	Verify 24 volts is applied to both Remote enable input on connector C3 and Motion Input (Sys.DIN.1) on connector C9. Check for Fault indication on LED display.
Cannot get to Sys.conmode =1 (0 or -1 remains on display)	Dip switch 1 and 6 not set to 1. Drive not configured for motor. Configure motor using the software.
Cannot get to Sys.Conmode = 2 (S remains on display)	Check ?SERVOERROR from BASIC Moves terminal for bad Motor configuration. Add statements to application program to set sys.conmode = 2.

Problem	Corrective Action
Lose communication with Basic Move when task(s) are executing	Communication with the RC is priority level 2. Do not set any task priority levels to 1 or 2. Task Priority level default is 16.
One or more BASIC Moves functions stop working	If after cycling power, select Debug| Reset Communications from the menu bar. Close and restart BASIC Moves
Operating problems	For standard operation, verify setting of DIP switches. SW 1 and 6 must be set to 1. All others to 0
Problems after changing Autoexec.prg or Config.prg task	Set DIP switch 6 to 0. Reboot and delete task config.prg or autoexec.prg. Reboot again with DIP switch 6 set to 1
Program stops running and Error box pops up in BASIC Moves	Open the Task Manager in BASIC Moves and review information shown: Task Status, Error and Source. Review information in BASIC Moves Message Log. Check **?SERVOERROR** in BASIC Moves terminal for error. Correct problem causing error. Check **?ERRORHISTORY** in BASIC Moves terminal. Correct problem causing error.
Very slow communications with BM when task(s) is executing	Multiple parameters in the BASIC Moves Watch Window can slow down communications
Watchdog Error (3 horizontal lines on display) after operating for some time	Check Loading of Processor (during operation). From terminal type **?Sys.AverageLoad** and **?Sys.peakLoad**.

Problem	Corrective Action
Watchdog Error (3 horizontal lines on display) at Start up	Possible error in Config.prg or Autoexec.prg. To check, delete Config.prg and Autoexec.prg from *PosiDrive RC* File Manager. Set DIP switch 6 to 0. Reboot and delete task config.prg and/or autoexec.prg. Reboot drive again with DIP switch 6 set to 1. ***Use Config.prg only to define user variables and allocate memory.*** Delete Var_file.cfg from terminal. Contact factory for assistance.

Error codes

In most cases, the *PosiDrive RC* communicates error codes with a text message via the serial port to the host. Some error codes are also transmitted to the Status Display. The same message is saved in the EEPROM under an error history log (FLTHIST, ERR) so nothing is lost when power is removed. Not all errors reflect a message back to the host. In these cases, the no-message errors communicate only to the Status Display.

The response of the ***PosiDrive*** to an error depends on the error's severity. There are two levels of severity:

1. Warnings (simply called errors and not considered faults and do not disable operation)
2. Fatal errors (fatal faults that disable almost all ***PosiDrive*** functions, including communications).

The PosiDrive automatically disables at the occurrence of a fault. Executing a PosiDrive disable command (DIS or K) followed by the EN command or toggling the Remote Enable line (REMOTE) resets the fault latch and, if the fault condition is no longer present, re-enables the system.

Fault Monitoring System

The ***PosiDrive***'s microprocessor is constantly monitoring the status of many different components. In general, the ***PosiDrive*** latches all fault conditions so you can readily determine the source of the problem. When a fault is detected, it is logged in the internal error log, indicated in the Status Display, enunciated over the serial port, and causes a ***PosiDrive*** disable. Many faults can be reset by toggling the hardware remote enable (REMOTE input).

The following provides a list of some of the more frequent faults the ***PosiDrive*** may detect in the unit hardware and operating system:

Bus OverVoltage: an over-voltage condition shuts down the ***PosiDrive*** and displays a lower-case 'o' in the status display. This fault occurs normally during REGEN operation where the BUS is raised to higher values than that produced by the power supply.

Bus UnderVoltage: an under-voltage condition shuts down the ***PosiDrive*** and displays a 'u' in the status display. This fault normally occurs when the incoming line voltage drops out or a fault occurs in the power supply.

C2: A C2 error indicates either a positioner fault such as excessive following error or that there is an error in the running of the application program. To obtain additional information on the cause of this error, from the terminal window type in:

```
?errorhistory
```

or

```
?servoerror
```

Drive OverTemperature: The internal heatsink temperature is monitored for an unsafe condition. This condition causes a 't' to be displayed and disables the ***PosiDrive***. The ***PosiDrive*** eventually cools enough to allow reset.

Feedback Loss: Hardware is used to detect a wire-break condition in encoder-based systems or the presence of the Sine and Cosine resolver feedback signals in resolver based systems. The lack or loss of either of these signals causes the ***PosiDrive*** to disable and display an 'r' in the status display.

Hardware Position Limit Inputs: The IN1, IN2, IN3 Inputs are constantly monitored. If the variables INxMODE set these inputs for CW/CCW hardware position limits, they are monitored for an open-circuit condition. Although not necessarily an error condition, motor operation can be effected by these inputs. The *PosiDrive RC* ignores the hardware position limits if you set LIMDIS = 1. The worst-case RCenario is that further motion in the given direction is not allowed with an 'L' in the status display. If both CW and CCW position limit inputs have detected an open-circuit condition, the *PosiDrive RC* enters into Hold position state (HOLD = 1).

Low-voltage power supply faults: Out of tolerance values on the ± 12 VDC analog supplies displays an 'A' and disables the ***PosiDrive***.

Memory reliability: During the initialization process upon power up, the run time, variables memory (RAM - Random Access Memory), and the program memory (EPROM - Electrically Programmable Read Only Memory) are tested.

If a RAM fault is detected, an 'I' is displayed and the ***PosiDrive*** halts. If an EPROM fault is detected, a 'c' is displayed and the ***PosiDrive*** halts.

The user configuration non-volatile memory (EEPROM - Electrically Erasable Programmable Read Only Memory) is also checked for integrity upon power-up. Any diRCrepancy in this data is noted with an 'e' in the status display. After power-up is successfully completed, any subsequent fault in the operation of the EEPROM is noted with an 'E' in the status display.

Motor OverTemperature: The Motor's External Thermostat input is monitored for an open circuit condition. You define (using THERMODE) what happens under this fault condition. The worst-case RCenario is a power stage disable when an 'H' appears in the status display, and the fault relay contacts (RELAY) are open.

No compensator: In case the ***PosiDrive*** cannot design a compensator, such as after a RSTVAR command, CLREEPROM, or any change in the motor or ***PosiDrive*** parameters, a flashing minus sign (-) is displayed and the ***PosiDrive*** is disabled. This display normally indicates that the ***PosiDrive*** does not have a compensation file loaded.

OverSpeed fault: Software continuously monitors the actual feedback speed. If the motor speed exceeds the VOSPD limit, a 'J' is displayed and the ***PosiDrive*** is disabled. This normally occurs when there is an improperly tuned system and the load overshoots its commanded speed.

PowerStage Fault (OverCurrent): Hardware circuitry monitors load short-circuit, transistor failure, and instantaneous OverCurrent. In general, a power stage fault cannot be reset by toggling the Remote Enable, only by power cycling. This condition is indicated by a flashing 'P' in the status display.

RMS OverCurrent (FoldBack): the FoldBack detection system can 'clamp' the available output current. This is not a true fault condition, but may cause undesired performance as the command current is limited below what is required to achieve the desired performance. This condition is indicated with a flashing 'F' in the status display and is detected by monitoring the FOLD switch variable.

WatchDogs: In addition, the ***PosiDrive*** incorporates a watchdog system to maintain software operation integrity. Failure of the watchdog mechanism displays three bars on the status display and halts the ***PosiDrive***. WatchDog faults can be caused by:

1. Syntax or programming error in the Config.prg or Autoexec.prg file.
2. Certain extreme CPU loading conditions.
3. More serious problem. Contact the factory for support

Message Faults

Status Display	Fault Message	POSSIBLE CAUSE	Err #
t	Power stage OverTemp	overload, fan malfunction, power stage failure	1
o	OverVoltage	excessive decel rate*	2
P	OverCurrent	power stage surge current*	3
r0	External feedback fault	Feedback signal through C8 not correctly detected	4.0
r1	Resolver line break	break in resolver feedback detected	4.1
r2	RDC error	fault in resolver-to-digital converted detected	4.2
r4	A/B line break	break in encoder A/B input lines detected	4.4
r5	Index line break	break in encoder index line	4.5
r6	Illegal halls	illegal hall combination detected	4.6
r7	C/D line break	break in sine encoder C/D line detected	4.7
r8	A/B out of range	sine encoder A/B level out of range	4.8
r9	Burst pulse overflow	sine encoder fault	4.9
u	Under voltage	bus voltage is too low	5
H	Motor over temperature	motor overload caused overheating	6
A1	Positive analog supply fail	Failure in +12V supply	7.1
A2	Negative analog supply fail	Failure in -12V supply	7.2
J	OverSpeed	velocity ≥ VOSPD	8
J1	OverSpeed	Velocity ≥ 1.8 x VLIM	8.1
E	EEPROM failure	Faulty EEPROM	9
e	EEPROM checksum fail	EEPROM checksum invalid on power up*	10
F	Foldback	System in FoldBack mode	12
d5	Positive over travel fault	PFB exceeded PMAX with PLIM=1	14.1
d6	Negative over travel fault	PFB exceeded PMIN with PLIM=1	14.2
d1	Numeric position deviation	Internal fault	15.1
d2	Excessive position deviation	PE > PEMAX	15.2
c	Communication interface	A communications fault has occurred	16

* These faults can only be cleared by cycling power

No Message Faults

Status Display	Flashing	Steady	Fault Description	Fatal	Non-Fatal
≡	✔		Watchdog (DSP)	✔	
≡		✔	Watchdog (HPC)	✔	
-1	✔		No Compensation	✔	
-2	✔		Invalid Velocity Control	✔	
-3	✔		Encoder not Initialized on attempt to enable	✔	
-4	✔		Encoder Initialization failure	✔	
L 1	✔		Hardware CW limit switch open		✔
L 2	✔		Hardware CCW limit switch open		✔
L 3	✔		Hardware CW and CCW limit switches open		✔
L 4	✔		Software CW limit switch is tripped (PCMD>PMAX & PLIM=2)		✔
L 5	✔		Software CCW limit switch is tripped (PCMD<PMIN & PLIM=2)		✔
A 3	✔		Positive and negative analog supply fail	✔	
I		✔	RAM failure (during init)	✔	
c		✔	EPROM checksum (during init)	✔	
E101	✔		Altera load failure (during init)		
E102	✔		Altera DPRAM failure (during init)		
E103	✔		DSP load fail (during init)		
E104	✔		DSP alive failure (during init)		
8	✔		Test LED		
C1	✔		Synchronization Error	✔	
C2	✔		Positioner fault (SYS.MOTION=0) SYS.MOTION must be 1.	✔	

Error Handler (1 through 999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
1	CPU Divide error	Generated by the CPU if the divisor of DIV instruction is zero or the quotient overflows the result register.	ASYNC	Fatal Fault	Watchdog
2	CPU Debug	Generated by the CPU after each instruction if Trap Flag is set.	ASYNC	Fatal Fault	
3	CPU NMI	Generated by the CPU when the input to the NMI pin is asserted	ASYNC	Fatal Fault	
4	CPU Breakpoint	Generated by one-byte breakpoint instruction.	ASYNC	Fatal Fault	
5	CPU Detected Overflow	The CPU will generate this error if Overflow Flag is set.	ASYNC	Fatal Fault	
6	CPU Bound range exceed	Generated by BOUND instruction when the value to be tested is less than the indicated lower bound or greater than the indicated upper bound.	ASYNC	Fatal Fault	
7	Invalid opcode	This error is generated when the CPU attempts to execute an invalid opcode.	ASYNC	Fatal Fault	Watchdog
8	CPU extension not available	This error is generated if a coprocessor instruction is encountered and a coprocessor is not installed.	ASYNC	Fatal Fault	Watchdog
9	CPU: double exception detected	This error is generated when multiple exceptions occur on one instruction of the CPU, or an exception occurs in an exception handler.	ASYNC	Fatal Fault	Watchdog
10	CPU Coprocessor overrun	This error is generated if the coprocessor attempts to access memory outside a segment boundary.	ASYNC	Fatal Fault	Watchdog
11	CPU Invalid Task State Segment	Automatically generated by CPU during task switch if the new TSS specified by the task gate is invalid.	ASYNC	Fatal Fault	Watchdog
12	CPU segment not present	Generated when loading a segment register of the CPU if the segment deRCriptor indicates that the segment is not currently in memory.	ASYNC	Fatal Fault	Watchdog
13	CPU Stack fault	Generated on a stack overflow or underflow or if an inter-level transition or task switch references a stack segment marked "not present".	ASYNC	Fatal Fault	Watchdog

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
14	CPU General protection fault	Generated when the CPU detects a protection violation which does not fit under another category having a separate interrupt. This error is generated on an 80486 protected- mode floating-point protection fault.	ASYNC	Fatal Fault	Watchdog
15	CPU Page fault	This error is generated on attempting to access a 4K memory page whose page table entry has the "present" bit cleared.	ASYNC	Fatal Fault	Watchdog
16	CPU Coprocessor fault	This error is generated if the coprocessor attempts to access memory outside a segment boundary; it may occur at any arbitrary time after the coprocessor instrunction was issued.	ASYNC	Fatal Fault	Watchdog
17	CPU Alignment error	Automaticly generated by the CPU if misaligned memory access is made.	ASYNC	Fatal Fault	Watchdog
18	Invalid FPU operation	Generally indicates a program error (*eg*, an out-of-range argument to trigonometric functions, SQRT of negative operand, logarithm of zero or negative operand).	ASYNC	Error	Idle Task
19	FPU: Unnormalized operand	This error is generated when an instruction attempts to operate on an operand that has not been normalized. The result may have reduced significance due to lost low-order bits.	ASYNC	Error	Idle task
20	FPU divide by zero	This error is generated when an instruction attempts to divide an operand by zero.	ASYNC	Error	Idle Task
21	FPU overflow	This error occurs if the magnitude of the rounded true result will exceed the magnitude of the largest finite number in the destination format.	ASYNC	Error	Idle Task
22	FPU Underflow	Two related events can contribute to this error: 1) creation of a very small operand which can cause some other exception later, and 2) overflow upon division producing an inexact result.	ASYNC	Error	Idle Task

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
23	FPU Precision lost	It occurs when the result of an operation is not exactly representable in the destination format. For example, 1/3 cannot be precisely represented in binary form. This exception occurs frequently and indicates that some (generally acceptable) exception has been lost. Most applications mask this exception.	ASYNC	Error	Idle task
24	FPU Stack fault	Generated on the FPU due to stack overflow or underflow.	ASYNC	Error	Idle Task
25	Invalid FPU operation	Generally indicates a program error (*eg,* out-of-range argument to trigonometric functions, SQRT of negative operand, logarithm of zero or negative operand). System Context	ASYNC	Fatal Fault	Watchdog
26	FPU: Unnormalized operand	When an instruction attempts to operate a non-normalized operand, the result may reduce significantly due to lost low-order bits. Most applications mask this exception. System Context	ASYNC	Fatal Fault	Watchdog
27	FPU Zero divide	This error is generated when an instruction attempts to divide a finite non-zero operand by zero. System Context.	ASYNC	Fatal Fault	Watchdog
28	FPU Overflow	This error occurs if the magnitude of the rounded true result will exceed the magnitude of the largest finite number in the destination format.	ASYNC	Fatal Fault	Watchdog
29	FPU Underflow	Two related events can contribute to this error: 1) creation of a very small operand which can cause some other exception later, and 2) overflow upon division producing an inexact result.	ASYNC	Fatal Fault	Watchdog
30	FPU Precision lost	It occurs when the result of an operation is not exactly representable in the destination format. For example, 1/3 cannot be precisely represented in binary form. This exception occurs frequently and indicates that some (generally acceptable) exception has been lost. Most applications mask this exception.	ASYNC	Fatal Fault	Watchdog

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
31	FPU Stack fault	Generated on the FPU due to stack overflow or underflow.	ASYNC	Fatal Fault	Watchdog
32	Unknown module ID	Internal error. Unregistered code of the module encountered in the error code.	ASYNC	Fatal Fault	Watchdog
33	Failed to create Logger MsgQ	Internal system resource cannot be allocated	ROOT	Fatal Fault	Watchdog
34	Failed to create logger task	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
35	Failed to write into Error History file	An error occured while writing to the log file. This can happen if many errors are generated simultaneously.	ASYNC	Error	None
36	Invalid logger message queue ID	Internal error. Contact technical support.	ASYNC	Fatal Fault	Watchdog
37	Failed to create logger mutex	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
38	Invalid logger mutex	Internal error. Contact technical support.	ASYNC	Fatal Fault	Watchdog
39	Task does not exist	It's impossible to retrieve error information about non-existent task. Generated in response to ERROR or ERRORNUM task query when task does not exist.	SYNC	Note	None
40	Invalid message queue	Invalid message queue ID	SYNC/ASYNC	Fatal Fault	Watchdog
41	Failed to create Error Handler task	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
42	Failed to create Error Handler MsgQ	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
43	Error message queue overflow	The error flow too intense. Some error messages may be lost.	ASYNC	Error	None
44	Logger message queue overflow	The error message flow is too numerous. Some error messages may be lost.	ASYNC	Error	None
46	Could not stop Interpreter	User process cannot be stopped by the Default system error handler.	ASYNC	Fatal Fault	Watchdog
47	Cannot proceed user error handler	Internal error. Contact technical support.	ASYNC	Fatal Fault	Watchdog
48	Error code with invalid severity	Internal error. Contact technical support.	ASYNC	Fatal Fault	Watchdog
49	Error code with invalid context info	Internal error. Contact technical support. Invalid context value recognized by the Error Handler state machine.	ASYNC	Fatal Fault	Watchdog

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
50	Cannot open Error History file	A file system error occured while opening Logger file.	ASYNC	Error	None
51	User error handler cannot be created.	An error occcured while spawning User error handler task. Add more memory.	SYNC	Error	None
52	User error handler MsgQ failed	Internal error. Contact technical support.	SYNC	Fatal Fault	Watchdog
53	User error handler stack allocation failed.	Could not create intenal data structure. Add memory or unload unnecessary tasks.	SYNC	Error	None
54	Reccuring attempt to define User System error handler	Only one instance of the User System error handler may exist.	SYNC	Error	Idle Task
55	User error handler stuck	User error handler cannot run.	ASYNC	Error	Watchdog
56	Unknown error	The error code cannot be recognized by the Error Handler.	ASYNC	Fatal Fault	Watchdog

Built In Test (1000 through 1999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
1000	No Error	No Error	SYNC	Note	
1001	Error creating the BIT task	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
1002	Error creating the semaphore	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
1003	System memory exhausted: unload tasks or add memory	The BIT task verifies that at least 200kBytes of contiguous memory are not available. Unload unnecessary tasks or add memory.	ASYNC	Note	
1004	Out of memory: add more memory or unload unnecessary tasks.	Out of memory. BIT is not able to allocate needed amount of RAM for the new handle. This can occur in response to the WdInit() function. Add more memory or unload unnecessary tasks.	SYNC	Error	Idle Task
1005	Invalid BIT handle	BIT task received an invalid handle (pointer). The handle is generated in response to the WdInit() function, and must be specified in the WdCycle() function	SYNC	Error	Idle Task
1006	Task stuck	One of the tasks that should report to BIT has not done so. A task tells BIT that it will report to init when it executes the WdInit() function. Thereafter, the task must execute WdCycle() periodically.	ASYNC	Fatal Fault	Watchdog

Run Time RCheduler (2000 through 2999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
2001	Unknown error	Unrecognized error code	ASYNC	Fatal Fault	
2002	Failed to create RTS MutEx	Failed to allocate data structure for MutEx semaphore.	ROOT	Fatal Fault	
2003	RTS semaphore failed	Failed to allocate data structure for synchronization semaphore	ROOT	Fatal Fault	
2004	Overlap error	Not enough sytem resourses to run all the mandatory system task.	ASYNC	Error	
2005	Invalid RTS element ID	Cannot perform RCheduling operation over unregistered RTS element.	ASYNC	Fatal Fault	
2006	Invalid mutex ID	Semaphore cannot be taken.	ASYNC	Fatal Fault	
2007	Unknown internal code	The task received invalid request for operation.	ASYNC	Fatal Fault	
2008	Not enough memory	Not enough memory to allocate internal data.	ASYNC	Fatal Fault	
2009	Failed to create RTS task	Failure while spawning the Real-Time RCheduler task	ROOT	Fatal Fault	

Motion (3000 through 3999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3001	Internal error	Contact technical support	SYNC	Error	
3002	Nonexistent axis	Internal error. An unknown axis number was given. This error can be caused only through an invalid input from the interpreter.	SYNC	Fatal Fault	Watchdog
3003	Nonexistent axis	Internal error.	SYNC	Fatal Fault	Watchdog
3004	Internal error.	Contact technical support.	SYNC	Error	
3005	Nonexistent axis	Internal error. Invalid axis handle was entered.	SYNC	Fatal Fault	Watchdig
3006	Element is already attached to a task	The element that is to be attached is already attached to a task. The error can occur in the Attach command or in any command that needs the attachment permission.	SYNC	Error	Idle Task
3007	Invalid mode	Internal Error. Invalid mode given. In many commands a mode variable is given. The mode can have only certain values depending on the command that is issued (MOT_MODAL, MOT_NODAL, MOT_IMMEDIATE).	SYNC	Fatal Fault	Watchdog
3008	Velocity out of range	The value of the velocity is not in the allowed range for this system variable (max. velocity, cruise velocity, final velocity, ...). For example, VMAX=-1	SYNC	Error	Idle Task
3009	Time value out of range	Invalid time duration value given. The time value (usually a time interval) is not in the allowed range.	SYNC	Error	Idle Task
3010	Wrong parameter value.	Invalid command value supplied. In all motion commands the appropriate value of the command parameters is checked (StopType, ProceedType,....)	SYNC	Error	
3011	Not available nodal package.	Internal Error. The variable is currently not available. Nodal variables can be queried also, although this feature is not supported by the user command set. The nodal package is not always available.	SYNC	Fatal Fault	Watchdog
3012	Acceleration out of range	The value of the acceleration is not in the range of allowed acceleration values. For example, ACC=-1	SYNC	Error	
3013	Deceleration out of range	The value of the deceleration is not in the range of allowed deceleration values. For example, DEC=-1	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3014	Jerk out of range	The value of the jerk is not in the range of allowed jerk values. For example, JERK=-1	SYNC	Error	
3015	Velocity override out of range	The value of the velocity override is out of the range of allowed values. For example, VELOCITYOVERRIDE = -1	SYNC	Error	
3017	Axis following error: verify PEMax	The position error of the axis is greater than the allowed error, as specified by PEMAX.	ASYNC	Error	Motion is stopped
3018	Wrong position value.	Invalid position value given. The given position is out of the defined position range for that axis.	SYNC	Error	
3019	Internal error	Internal error. Cannot delete an axis.	SYNC	Fatal Fault	Watch dog
3020	The element is moving	This error is returned when attempting to enter three Move commands from the terminal. Only two move commands are buffered from the terminal. The error is also returned when attempting to enable gearing/camming when the axis is already in motion.	SYNC	Error	
3022	Absolute homing maximum distance exceeded. The home procedure will be stopped.	There is a maximum homing distance defined for a safety measure in cases when homing fails.	SYNC	Error	
3025	Axis active	Contact technical support.	SYNC	Error	
3026	Motion inhibited: Set Motion flag to ON	Motion on the specified element is inhibited by the MOTION property.	SYNC	Error	
3027	Internal error	Contact technical support.	SYNC	Error	
3029	Internal error	Contact technical support.	SYNC	Error	
3033	SYNC flag not set: set StartType to SYNC	The SyncStart command was issued upon an element for which the StartType is not defined as SYNC.	SYNC	Error	
3035	Synchronized movement is pending: clear sync using SyncClear command	There exists a pending synchronized movement for the motion element. The motion element cannot be moved until the SyncStart command has been issued, or the synchronization has been cleared with the SyncClear command.	SYNC	Error	
3036	Automatic braking	The element is being automatically stopped. This can occur when the final velocity is nonzero and there are no pending motion commands.	ASYNC	Error	
3037	Not stopped.	The proceed command given to a element that was not stopped.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3038	The element is stopped from another task	Cannot define gearing/camming when the element is stopped by another task. The STOP command also inhibits motion in this case.	SYNC	Error	
3039	Only the task can Proceed	The element has been stopped by a task. The Proceed command must come from a task, and not from the terminal.	SYNC	Error	
3040	Only the terminal can Proceed	A motion element that has been stopped by a STOP command from the terminal can be Proceeded only by a proceed command from the terminal, and not from another task.	SYNC	Error	
3041	Nothing to proceed	The Proceed command has been issued on an element that has not been stopped.	SYNC	Note	
3042	Proceed in progress.	There are certain restrictions for the proceed/stop commands. See the sdd document.	SYNC	Error	
3043	Cannot execute move. Element is stopped by another task.	When an element has been stopped with the STOP command, it is not possible to Move it until the same task that executed the Stop command issues the Proceed command.	SYNC	Error	
3044	Jog is not allowed: specify axis name	Jog can be done on single axis only.	SYNC	Error	
3045	Wrong speed override value.	The percentage that is given to the velocityoverride function is limited. Refer to the Reference Manual for the allowed range.	SYNC	Error	
3046	Smooth factor out of range	Smoothing value given is not in range. Refer to the Reference Manual for the allowed range.	SYNC	Error	
3047	Excessive Jerk/Acceleration ratio: decrease jerk or increase accel and decel	The Jerk/Acceleration ratio defines the time needed to achieve maximum acceleration. If this time is shorter then 5 motion samples the new Jerk/Acceleration is not accepted. The ratio is limited by 0.9*PI/(5T), where T is the cycle time in milli seconds. Thus, the limit is 282.74 when the cycle time is 2 msec, and 141.37 when the cycle time is 4 msec. Use a SmoothFactor from 0 through 100 to get around the Jerk limitations.	SYNC	Error	
3048	Proceed command may be entered from terminal	If the task that stopped the motion was killed, or terminated without giving the Proceed command, the Proceed command is allowed from the Terminal.	SYNC	Note	
3049	Axis is disabled.	The axis has been disabled.	SYNC	Note	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3050	The movement has been recalculated	There has been a change in the status of the motion, between the time movement calculation started, but before that movement could be executed.	SYNC	Note	
3052	Internal error	Contact technical support.	SYNC	Error	
3053	Wrong master declaration.	Wrong definition of master. The user will not see this error, since the command is filtered before it gets to the Motion.	SYNC	Error	
3054	Invalid slave specification	Contact technical support.	SYNC	Error	
3055	The element is already a slave	Cannot declare a master or a slave (gear or cam) when the axis is already a slave.	SYNC	Error	
3056	Axis is a slave: absolute motion not allowed	An absolute position motion is not allowed if the axis is set up as a slave.	SYNC	Error	
3057	Absolute move not allowed on slave axis	This error occurs when attempting to execute an absolute move command on a slave axis. Only incremental moves are allowed on the slave axis.	SYNC	Error	
3058	The drive is disabled or in the following mode; no motion allowed	Movement cannot be commanded if the drive is disabled or the axis is in a following mode.	SYNC	Error	
3059	Master axis unknown: specify master source	This error is generated when a master declaration is missing. Existence of a master is checked when an axis is declared as a slave.	SYNC	Error	
3060	Invalid cam index	Internal error. This error appears when there is a cam query and the cam is not recognized.	SYNC	Fatal Fault	
3061	Can't declare more cam tables.	Cam table cannot be defined. The number of cam tables that can be defined is limited to 256.	SYNC	Error	
3062	Wrong cam table size	Cam table size must be modulo 16. This error is returned when loading a cam file using the LoadCamData command.	SYNC	Error	
3063	Problem reading cam data file: verify file size and existence.	There was a problem while reading data from the file. The number of data items that were read from the file does not match the file size, or the file doesn't exist.	SYNC	Error	
3064	No NEXT cam table: camming terminated and slave axis stopped	The end of the cam table has been reached and there is no next cam table. The axis will stop and is taken out of slave mode.	ASYNC	Note	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3065	No PREVIOUS cam table: camming terminated and slave axis stopped	The beginning of the cam table has been reached and there is no previous cam table. The axis will stop and is taken out of slave mode.	ASYNC	Note	
3066	Two identical master values inside cam table: change cam table	Two identical master values were found inside the cam table when monotonicity was checked.	SYNC	Error	
3067	The cam table is not monotonic	Cam table must be monotonic (up or down). Monotonicity is checked when an axis is declared as a slave or when a file is loaded into a cam table.	SYNC	Error	
3068	Cam offset not found in the cam table	The specified CamOffset is not found in the cam table. The value of the CamOfsfet must be given as one of the Master position values in the cam table.	SYNC	Error	
3069	The cam table is already linked: unlink table before changing it	File cannot be loaded into the cam table if it is chained. The cam table cannot be deleted if it is chained.	SYNC	Error	
3072	Enabled.		SYNC	Error	
3073	Time cannot be negative.	Specification for Time must be positive.	SYNC	Error	
3074	Cam table is empty.	The cam table is been checked when loading a file or when an axis is declared as a slave (camming mode)	SYNC	Error	
3075	Gear ratio out of range	The gear ratio is out of range. Refer to the GearRatio axis property in the Reference Manual.	SYNC	Error	
3076	Desynchronization between tasks while gearing		SYNC	Error	
3077	The Cam data array is in use	When the Cam data array is in use, operations on it are limited: 1) loading a file into the data array , 2) storing the array, 3) re-create the data array , 4) writing slave or master values into the array. A cam data array is in use when that array is the active cam of the axis.	SYNC	Error	
3078	Cam cycles out of range	The specified number of cam cycles is out of range. Refer to the CYCLE cam property deRCription in the Reference Manual.	SYNC	Error	
3079	No active cam.	No cam is defined for the axis. This error is returned when the following axis property queries are issued: ActiveCam, CamCycle, CamIndex.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3080	Wrong file extension: must be .cam	The cam file extension must be .CAM	SYNC	Error	
3081	Cam chain is not connected correctly.	When the axis is moving to the next/previous table the connection between the tables is checked. If the connection is not correct the axis will stop and is taken out of slave mode.	ASYNC	Error	
3082	Feedback velocity is out of limit	The actual velocity is limited by the VelocityOverspeed property. When the actual velocity exceeds the VelocityOverspeed, the motion is stopped.	ASYNC	Error	Motion is stopped
3083	Feedback velocity is out of limit when motion is stopped: drive disabled	The actual velocity is limited by the VelocityOverspeed property. When the actual velocity exceeds the VelocityOverspeed, the motion is stopped. If this happens when motion is already stopped, then the drive is disabled. This may indicate a drive tuning problem or a noise problem.	ASYNC	Error	Drive is disabled
3084	Wrong velocity over speed value		SYNC	Error	
3085	Incorrect parameter value		SYNC	Error	
3086	Incorrect number of point coordinates given to this movement		SYNC	Error	
3087	Target position will exceed the limit		SYNC	Error	
3088	Wrong factor value : specify a positive value		SYNC	Error	
3089	Property value cannot be changed while drive is enabled	Some properties, such as conversion factors, cannot be changed while the drive is enabled. Refer to the Reference Manual for limitations on instruction execution.	SYNC	Error	Idle Task
3096	Minimum position limit must be less than the maximum limit		SYNC	Error	
3098	Time value inaccuracy: value is rounded up to nearest integer multiple of 1 ms.	The settling time (TSettle or TSettleMax) must be an integer multiple of 1 ms. If it is not, the time specified is accepted, but the actual settling time is rounded up to the nearest integer multiple of 1 ms.	SYNC	Note	
3099	Cannot execute InPosition	The INPOSITION value of the StartType has no meaning when the previous movement is with nonzero final velocity.	SYNC	Note	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3101	Time jog is meaningless		SYNC	Note	
3102	The index is out of the table range.	The index is out of the cam table range. This error is returned when attempting to access a value in the cam table, where the index is greater than the number of points in the table.	SYNC	Error	
3103	Given value will cause cam table to be non-monotonic: value not accepted.	The cam table is chained, but the data are not in use. The given value for the master would cause the table to be non-monotonic, and so the value is not accepted.	SYNC	Note	
3104	The movement is calculated until the position limit		SYNC	Note	
3107	Initialized the velocity to its maximum		ASYNC	Note	
3112	Initialized the acceleration to its maximum		ASYNC	Note	
3113	Initialized the deceleration to its maximum		ASYNC	Note	
3114	Initialized the jerk to its maximum		ASYNC	Note	
3115	System entered into following mode, all motions aborted		SYNC	Note	
3129	Task start failure.	Internal Error. Cannot start the task. The error is returned from the VxWorks function.	SYNC	Fatal Fault	
3130	Task end failure.	Internal Error. Cannot end the task. The error is returned from the VxWorks function.	SYNC	Fatal Fault	
3131	Invalid semaphore ID or time-out elapsed.	Internal Error. Invalid semaphore ID. The error is returned from the VxWorks function.	SYNC	Fatal Fault	
3132	Invalid message.	Internal Error. Invalid message received by the Motion Manager. The Motion Manager is a message driven task. Receiving an invalid message is a fatal system fault.	SYNC	Fatal Fault	
3133	Invalid element handle.	Internal Error. Invalid element handle encountered during the real time execution. The error is identical to the MOT_ERR_IELEMENT but this time the source is internal (not the interpreter)	ASYNC	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3134	No memory.	Internal Error. No more free memory in the system. The memory of the system is exhausted. The memory for the motion should be always available.	SYNC	Fatal Fault	
3135	Invalid pointer.	Internal Error. Invalid pointer encountered during the real time execution. A zero pointer was found in the RTK or MM task.	SYNC	Fatal Fault	
3136	Corrupted task data.	Internal Error. Invalid task data. Each attached task is represented by a block of data; if these data are corrupted a fatal system error occurs.	SYNC	Fatal Fault	
3137	Task mismatch.	Internal Error.	SYNC	Fatal Fault	
3138	Bad dimension.	Internal Error. The element dimension is invalid.	SYNC	Fatal Fault	
3139	Corrupted data	Internal Error. During the element deletion procedure, corrupted data were encountered. When the element data are deallocated, a number of checks are conducted. Among the checks is verification that all allocated motion packages are deleted; if not the error is set.	SYNC	Fatal Fault	
3140	RTS blocked.	Internal Error. The RTS didn't release the semaphore. The RTS releases this semaphore periodically, but if the semaphore is not released after two time periods, this error is set. It is an indication that the RTS is not functioning properly or that the interrupt handler stopped.	ASYNC	Fatal Fault	
3141	Bad profile data.	Internal Error. Profiler error. Invalid data for the profile calculation given.	SYNC	Fatal Fault	
3142	RTS element add failed.	Internal Error. The RTS failed to add an element. The RTS refused to add new element in its table.	SYNC	Fatal Fault	
3144	RTS clear motion failed.	Internal Error. The RTS failed to clear the motion enable flag. The error can occur during the RTK initialization or during the suspend-resume transitions.	ASYNC	Fatal Fault	
3145	RTS set motion failed.	Internal Error. The RTS failed to set the motion enable flag.The error can occur during the RTK initialization or during the suspend-resume transitions.	ASYNC	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3146	RTS overrun clear failed.	Internal Error. The RTS failed to clear the overrun flag. Occures in the run time only.	SYNC	Fatal Fault	
3147	RTS delete failed.	Internal Error. The RTS failed to delete an element. At the end of the deletion task, the system failed to delete the RTS entry. Recovery action is not needed because the task is already dead.	SYNC	Fatal Fault	
3148	Computing too late	The precomputation is late. For immediate motion changes such as immediate move or speed override, a precomputation time delay is assumed. Normally this delay should be sufficient to complete computation. This error generally indicates that the system is too heavily loaded.	ASYNC	Error	
3149	Unable to create system resource.	Internal Error. The VxWorks is unable to crate the resource (Queue, Semaphore, ...) Possible cause: No more memory, VxWorks down.	SYNC	Fatal Fault	
3150	Invalid profiler parameters.	Internal Error. Invalid profiler parameters.	Sync	Fatal Fault	
3151	Profiler in motion.	Internal Error. Certain profiler settings can be done only when the acceleration is zero.	SYNC	Fatal Fault	
3152	Invalid profiler status.	Internal Error. The profiler is state driven. If an invalid status is encountered this error occurs.	SYNC	Fatal Fault	
3153	RTK continuously interrupting.	Internal Error. The RTK is in a continuously repeating stop state.	ASYNC	Fatal Fault	
3154	Maximum Position reached.	Maximum axis limit reached. Usually by a JOG command.	SYNC	Error	
3155	Minimum position reached	Axis minimum limit reached. Usually by a JOG command.	SYNC	Error	
3156	No previous package.	Internal Error. In the precalculation process a pointer of the previous package in the m.p. ring is needed.	SYNC	Fatal Fault	
3158	Property value cannot be changed while drive is disabled		SYNC	Error	
3159	No memory for axis definition	No more free memory in the system. The memory of the system is exhausted.	SYNC	Error	
3160	Wrong PLS index.	Wrong PLS index.	SYNC	Error	
3161	Can't declare more PLS's	A maximum of 65536 PLS can be declared.	SYNC	Error	
3162	PLS property cannot be set while PLS is enabled	Certain PLS properties cannot be set while the PLS is enabled. First, disable the PLS, then change the property value.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3163	PLS value cannot be accessed before the PLS data are created	In order to operate on a PLS, the PLS must be defined (using Common Shared ... As PLS), and the PLS data must be created (using CreatePlsData).	SYNC	Error	
3164	PLS position index out of range	This error is returned when attempting to access a non-existent PLS position. The number of PLS positions is set when creating the PLS data structure (using CreatePlsData).	SYNC	Error	
3165	PLS position data must be monotonic	The data in the PLS data structure must be arranged in aRCending order. The order is verified when attempting to enable the PLS.	SYNC	Error	
3166	PLS output polarity must be binary (0 or 1)	The PLS output polarity must be binary (0 or 1).	SYNC	Error	
3167	Wrong value for the repetition interval.	Wrong value for the repetition interval.	SYNC	Error	
3168	PLS Enable must be binary (0 or 1)	The PLS Enable must be binary (0 or 1)	SYNC	Error	
3169	Fatal Fault, the error number is not defined by the programmer	Internal error	SYNC	Fatal Fault	Watch dog
3170	PLS Hysteresis must be positive	The value specified for the PLS Hysteresis must be positive.	SYNC	Error	
3171	PLS cannot be deleted while it is enabled	PLS cannot be deleted while it is enabled. First disable the PLS using the PlsEnable property.	SYNC	Error	
3172	Wrong output index.	Wrong output index.	SYNC	Error	
3173	Cannot attach element. Element is stopped by another task: issue PROCEED command	The STOP command is used both to stop motion and to inhibit further motion. If the Stop command has been issued from the terminal or a task, then the motion element cannot be attached by another task until the Proceed command has been issued.	SYNC	Error	
3174	Current property cannot be changed for a Master axis	Current property of an axis that is defined as a Master axis cannot be changed. First disable the Master/Slave by setting the Slave property of the slave axis to OFF.	SYNC	Error	
3177	Cannot execute the MOVE command	Contact technical support.	SYNC	Error	
3178	Cannot execute the stop command	Contact technical support.	SYNC	Error	
3179	Cannot MOVE IMMED. Proceed motion	Contact technical support.	SYNC	Error	
3182	Disable time out expired: 1 ms phase reduced to 0	Disable timeout of the drives expired	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3183	Settling time expired	Timeout for acheiving position expired	SYNC	Error	
3184	Maximum trial time to settle is less than settling time	Maximum trial time to settle is less than settling time	SYNC	Error	
3186	Motion Buffer Full	There are already 2 motions pending in the motion buffer	SYNC	Error	
3192	Element is not attached	Trying to move an element that is not attached.	SYNC	Error	
3196	Wrong factor value: specify a non zero value	Wrong factor value: specify a non zero value	SYNC	Error	
3240	Property valid for axis only	Some motion element properties are valid for an axis only.	SYNC	Error	
3241	Delay cannot be used with the StartType set to Immediate.	The DELAY command is subject to the StartType of the motion element being delayed. However, using StartType Immediate with the DELAY command is not allowed. Change the StartType before executing the DELAY command.	SYNC	Error	Idle Task
3247	System Motion property can be set only from the terminal	The Default System Error Handler sets the System Motion flag low. Once this happens, though, the Motion property can be set high only when the System.Motion=ON command is issued form the terminal.	SYNC	Error	
3248	Wrong motion type	Internal Error. Invalid command given. In all motion commands the appropriate value of the command parameters is checked (MOT_LINEAR, MOT_CIRCULAR, MOT_JOG)	SYNC	Fatal Fault	
3249	System automatic braking	The velocity is not zero, therefore the element is stopped by the system. This can occur, for example, when a slave axis has passed its position limits. The asis is then stopped by the system.	ASYNC	Fatal Fault	
3250	Invalid Motion Type	Motion types are LINEAR or ROTARY.	SYNC	Error	
3251	RTS set motion failed in initialisation.	Internal error. The RTS failed to set the motion enable flag.The error can occur during the RTK initialization or during the suspend-resume transitions.	ASYNC	Fatal Fault	
3252	RTS clear motion failed in initialisation.	Internal error. The RTS failed to clear the motion enable flag. The error can occur during the RTK initialization or during the suspend-resume transitions.	ASYNC	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
3253	Following error when motion is stopped: drive disabled. Check value of PEMAX.	There is no motion commanded, but still there is a position error. The maximum position error (PEMax) may be set too low, or the axis may be moved by external force, or the drive may not be tuned properly.	ASYNC	Error	Drive is disabled
3254	Envelope error when motion is stopped: drives disabled. Check value of PEMAX	There is no motion commanded, but still there is an envelope error. The maximum position error (PEMax) may be set too low, or the axis may be moved by external force, or the drive may not be tuned properly.	ASYNC	Error	Drive is disabled.
3255	Fatal error	Contact technical support.	SYNC	Fatal Fault	

File System (4000 through 4999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
4000	No Error	No Error	SYNC	Note	
4000			SYNC		
4001	Error opening file for Retrieve	Error opening file for Retrieve	SYNC	Error	
4002	Error opening the file for Send	Error opening the file for Send	SYNC	Error	
4003	Creating message pipe for upload	Internal Error.	SYNC	Error	
4004	Creating message pipe for download.	Internal error.	SYNC	Error	
4005	Removing message pipe for upload	Internal error.	ASYNC	Error	
4006	Removing message pipe for download	Internal error.	ASYNC	Error	
4007	Upload task exists	Internal error.	SYNC	Error	
4008	Download task exists	Internal error.	SYNC	Error	
4009	Creating upload task	Internal error.	SYNC	Error	
4010	Creating download task	Internal error.	SYNC	Error	
4011	Cannot create RAM drive device	Internal error.	ROOT	Fatal Fault	Watchdog
4012	Bad initialization option	Internal error.	SYNC	Error	
4013	No memory for RAM drive volume	There is not enough memory to create the RAM disk. Possible solution: add more memory or delete unneeded files.	SYNC	Error	
4014	Time-out during file transfer	Host has interrupted file transfer operation.	ASYNC	Note	
4015	No disk space	File operation could not be accomplished due to the lack of disk space.	SYNC	Error	
4016	File not found	Cannot locate the file	SYNC	Error	
4017	Error opening file	Error opening file	SYNC	Error	
4018	Error closing file	Error closing file	SYNC	Error	
4019	Disk full	There is no free disk space on the file device.	SYNC	Error	
4020	Invalid device name	Invalid device name specified for the file operation.	ROOT	Fatal Fault	Watchdog
4021	File cannot be deleted	There is no permission to delete the file.	SYNC	Error	
4024	Reading directory	An error occured while executing DIR command	SYNC	Error	
4025	Cannot create directory - it already exists or access is forbidden.	Cannot create directory because it already exists or access is forbidden.	SYNC	Error	
4026	Closing directory	An error occurred during execution of the DIR command	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
4027	No memory for file data structure	Cannot allocate internal data structure. Add more memory or unload tasks that are not needed.	SYNC	Error	
4028	Error writing into file	Error writing into a file	SYNC	Error	
4029	Error reading from file	Error reading from a file	SYNC	Error	
4030	Bad access to the file	Invalid pointer to the file handle	SYNC	Error	
4031	File extension is not recognized	Only specific file extensions are recognized. These are PRG for programs, REC for record files, CAM for cam files.	SYNC	Error	
4032	Cannot access this type of file	Access to this type of file is not permitted by the system.	SYNC	Error	
4033	File does not exist	This message is given when trying to operate on (Retrieve, Delete, Load) a file that does not exist on the flash disk.	SYNC	Error	
4034	Root directory is full	The number of files in the the root directory has reached the maximum number of files allowed.	SYNC	Error	
4035	Invalid semaphore ID	Invalid semaphore ID. The semaphore guards linked list of the files.	SYNC	Fatal Fault	
4037	Password invalid	Invalid password entered	SYNC	Error	
4038	Password protected	The file cannot be Deleted or Retrieved because it is protected by a password. Use the ProgramPassword command to remove the preotection.	SYNC	Error	
4039	Error setting the password	Cannot write into the system password's log.	SYNC	Error	
4040	File in use: access denied	A file with same name already has been opened. If it was open for reading you cannot open it for writing.	SYNC	Error	
4041	No available file deRCriptors	No file deRCriptors available at the current directory.	SYNC	Error	
4042	Illegal name	The file name is illegal from the File system's point of view.	SYNC	Error	
4050	Volume not available	Volume not available	SYNC	Error	
4051	Internal file system error	Internal error.	SYNC	Error	
4052	Opening directory	An error occured while accessing a directory	SYNC	Error	
4053	Unknown error	An unknown error code was generated while the File System was in operation.	SYNC	Fatal Fault	

Entry Station (5000 through 5999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
5000	No Error	No Error	SYNC	Note	
5001	Failed to open device driver.	Internal error. Contact technical support	ROOT	Fatal Fault	Watchdog
5002	Failed to create ouput pipe: add more memory.	Faled to create pipe. Add more memory.	ROOT	Fatal Fault	Watchdog
5003	Failed to open output pipe.	Internal error. Contact technical support	ROOT	Fatal Fault	Watchdog
5004	Failed to create input task: add more memory.	Not enough memory to create task. Add more memory	ROOT	Fatal Fault	Watchdog
5005	Failed to create output task: add more memory.	Not enough memory to create task. Add more memory	ROOT	Fatal Fault	Watchdog
5006	Failed to create semaphore: add more memory.	Faled to create sync semaphore: add more memory.	ROOT	Fatal Fault	Watchdog
5007	Failed to install driver.	Internal error. Contact technical support	ROOT	Fatal Fault	Watchdog
5008	Failed to add device to IOsys.	Internal error. Contact technical support	ROOT	Fatal Fault	Watchdog
5009	Serial communication error; Bad BCC: try again	Failed to match Block control character in message	ASYNC	Error	
5010	Serial communication error; Bad protocol data: try again	Faled to detect new line in message	ASYNC	Error	
5011	Serial communication error; Bad protocol data format: try again	Faled to format output message	ASYNC	Error	
5012	Failed to write translator input.	Memory exhausted on RAM drive. Add memory or delete REC files.	Terminal	Error	
5013	Failed to read translator input.	Internal error. Contact technical support	Terminal	Error	
5014	Failed to write translator output	Internal error. Contact technical support	Terminal	Error	
5015	Failed to create semaphore: add more memory	Failed to create mutex for active context. Add more memory.	ROOT	Fatal Fault	Watchdog
5016	Failed to run loader.	Internal error. Contact technical support	Terminal	Error	
5017	Failed to run Interpreter.	Internal error. Contact technical support	Terminal	Error	
5018	Failed to run Backend.	Internal error. Contact technical support.	Terminal	Error	
5019	Failed to run Translator.	Internal error. Contact technical support	Terminal	Error	
5020	Failed to create internal file: add more memory.	Failed to create back-end output file. Add more memory.	ROOT	Fatal Fault	Watchdog

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
5021	Failed to create memory device	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
5022	Virtual input index out of range	Virtual input is out of range. Refer to Sys.Vin in Reference Manual.	SYNC/ASYNC	Error	Idle Task
5023	Virtual output index out of range	Virtual output is out of range. Refer to Sys.Vout in Reference Manual.	SYNC/ASYNC	Error	Idle Task
5024	Internal error	Contact technical support.	SYNC	Error	Idle Task
5025	Fast data array index out of range.	Index specified for fast data must be within the range. Refer to fast data properties in Reference Manual	SYNC	Error	Idle Task
5026	Incorrect fast data check sum.	Fast data are not initialized. The host must write valid data before the MC reads it.	SYNC	Error	Idle Task
5027	Invalid Fast Data semaphore id.	Internal error. Contact technical support.	SYNC/ASYNC	Fatal Fault	Watchdog
5030	Unknown error	Internal error. Contact technical support	Terminal	Fatal Fault	Watchdog
5036	Error code is invalid	Internal error. Contact technical support.	ASYNC	Fatal Fault	Watchdog

Loader (6000 through 6999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
6000	No Error	No Error	SYNC	Note	
6001	Task already exists,	When loading a user task or defining a new event, a process with the same name may already exist. Source : Load, OnEvent	SYNC	Error	
6002	Failed to open program file	Failed to open a program file for reading because it: 1) does not exist, 2) there are too many open files, or 3) there is not enogh memory. If this occurs on power up, verify that the CONFIG.PRG file exists with valid data.	SYNC	Error	
6003	Bad element index,	Bad task index passed as a parameter. Indicates that system data are not reliable anymore. Data problem Source : Task priority updated, event prolog,epilog	SYNC	Fatal Fault	
6004	Array overflow	Too many events/tasks defined (task load, event create) Source : Load, OnEvent	SYNC	Error	
6005	Failed to open translator map file,	Failed to create MAP file. Source: Loader	SYNC	Error	
6006	Cannot open translator error file,	Failed to create translator error file in root Source : Loader	SYNC	Error	
6007	Task must be killed first	Cannot unload a task if it is not in either the Killed state or the Ready state.	SYNC	Error	
6008	Task does not exist	When unloading the user task or event: the process with the name specified may not exist. Source: Unload, EventDelete, Task priority get.	SYNC	Error	
6009	Failed to run interpreter,	Failed to call interpreter function or spawn interpreter task. Resource problem Source : configuration (root),Load,OnEvent	SYNC/ROOT	Error	
6010	Event task already exists	Event task with given name already exists.	SYNC	Error	
6011	Failed to create data segment,	Cannot allocate data segment when Loading the task. Resource problem Source : Load	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
6012	Failed to create code segment,	Cannot allocate code segment when loading the task. Resource problem Source : Load	SYNC	Error	
6013	Invalid semaphore ID,	Failed to take ITCB mutex. Bad pointer Source : any ITCB routine which tries to update ITCB data (Load,Unload, Priority etc, OnEvent etc.)	SYNC	Fatal Fault	
6014	Failed to create data stack,	Cannot create interpreter data stack when Load or OnEvent is attempted Resource problem Source : Load, OnEvent	SYNC	Error	
6015	Failed to create function stack,	Cannot create interpreter Func stack when Load or OnEvent. Resource problem Source : Load, OnEvent	SYNC	Error	
6016	Failed to create command line code segment,	Cannot create command line code segment	ROOT	Fatal Fault	
6017	Failed allocate memory for event node,	Cannot allocate memory for event node. Resource problem Source : Load, prolog, epilog	SYNC	Error	
6018	Specified priority does not exist.	Lookup in event list by priority or by event itcb idx failed. The problem may lie with data reliability because some procedures look for elements in the event list. If the element is not in the list, the task is aborted Source : event list management, priority modify Comment : cannot happen during normal runtime	SYNC/ASYNC	Fatal Fault	
6019	Invalid event node,	Invalid event ID. NULL reference to current/previous active events. Resource problem Source : event management, priority modify	SYNC/ASYNC	Fatal Fault	
6020	Invalid parent task node,	Invalid parent task ID. Requested ITCB idx is not the same as in the event list. Data integrity violated. Source: Load, Unload Comment : cannot hapen during normal runtime	SYNC	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
6021	Invalid interpreter pointer,	NULL pointer to internal interpreter registers encountered. Source : event management Comment: cannot happen during normal runtime. If the error occurs, then this task cannot be handled: NULL pointer to interpreter but ITCB index still exists.	SYNC/ASYNC	Fatal Fault	
6022	Invalid operation code	Invalid operation code for loader handler	SYNC	Error	
6023	Invalid event list mutex,	Cannot take event list mutex, for it is invalid). Bad pointer Source : event management (prolog, epilog), Load, Unload, OnEvent	SYNC/ASYNC	Fatal Fault	
6024	Failed to delete OnError handler	Cannot delete OnError handler (message queue, interpreter) Source : OnError	SYNC	Error	
6025	Invalid OnError message queue	Invalid OnError message queue ID. Bad pointer. Source : sending error message to OnError task	ASYNC	Fatal Fault	
6026	Illegal task priority	Illegal priority 0 (which is reserved for OnError) specified Source : load, OnEvent,priority modify	SYNC	Error	
6027	Invalid parent task semapore	Happens when an attempt to take parent task sync semaphore fails. Source : Loader, OnEvent, OnError	SYNC	Fatal Fault	
6028	Invalid translator mutex	Happens when an attempt to take translator mutex fails. Source : Loader, OnEvent, OnError	SYNC	Fatal Fault	
6029	Zero file size detected.	Cannot load an empty file.	SYNC	Error	
6030	Failed to create user task error handler	Cannot create default task error handler (task spawn, message queue) Source : Load	ROOT	Fatal Fault	
6031	Command given in invalid context.	Command given in invalid context.	SYNC	Note	
6032	Invalid priority range.	Invalid priority specified.	SYNC	Note	
6033	Failed to create translator mutex	Occurs at start up when creating translator mutex fails. Source : Loader, OnEvent, OnError	ROOT	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
6034	Failed to open translator output file,	Failed to create permanent translator output file Source : Root	ROOT	Error	
6035	Failed to open backend output file,	Failed to create permanent backend output Source : Root	ROOT	Fatal Fault	
6036	Cannot open translator string file,	Failed to create translator string file in root Source : Root	ROOT	Fatal Fault	
6037	Failed to create mutex,	Failed to create loader mutex in ITCB initialization Source : Root	ROOT	Fatal Fault	
6038	Failed to create sync semaphore	Root : there is one common sync semaphore for creating tasks and events	ROOT	Fatal Fault	
6039	Failed to retrieve system settings	Failed to retrieve system settings	SYNC/ASYNC	Fatal Fault	
6040	Failed to create command line files.	Failed to create temporal command line files (ITCB init) Source : Root	ROOT	Fatal Fault	
6043	Cannot delete task STDIN	Failed to delete the input message queue for a task.	SYNC	Error	
6045	No permission: stop the task(s) first	Reset ALL is not allowed if any task is running.	SYNC	Error	
6046	File cannot be loaded	This error occurs when trying to load config.prg, system, or other reserved file.	SYNC	Error	
6047	Invalid Translator mutex	Invalid mutex, Internal error due to memory corruption or limited memory.	SYNC	Fatal Fault	
6048	Invalid operation code	Invalid operation code.	SYNC	Fatal Fault	
6050	Unknown error	Unknown error	SYNC	Fatal Fault	

Translator (7000 through 7999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7000	No Translation Errors	No Translation Errors	SYNC	Error	
7001	Error writing to internal translator output file	Error writing to ouput file of translator. The translator uses a temporary file on the RAM disk. Add more memory or delete unneeded REC files. This error aborts the translation process.	SYNC	Fault	
7002	Error writing to internal translator temporary file	Error writing to the temporary file of the translator. The translator uses a temporary file on the RAM disk. Add more memory or delete unneeded REC files. This error aborts the translation process.	SYNC	Fault	
7003	Error writing to translator error file	Error writing to the error file of the translator. The translator error file is stored on the RAM disk. Add more memory or delete unneeded REC files. This error aborts the translation process.	SYNC	Fault	
7004	Error writing to translator MAP file	Error writing to the map file of the translator. This error aborts the translation process.	SYNC	Fault	
7005	Errors found during translation	Errors were found during translation. This general message is returned after a LOAD command if translation errors were found in the task. The error severity is FATAL FAULT if a translation error is found in the CONFIG.PRG file.	SYNC	Error	
7006	Variable could not be added to internal symbol table	Internal error. Add more memory. This error will abort the translation process.	SYNC	Fault	
7007	Variable already declared	A variable can be declared only once.	Translation	Note	
7008	Subroutine already exists	The subroutine has already been defined	Translation	Error	
7009	Translator temp file could not be opened	Internal error. The temporary file of the translator could not be opened.	SYNC	Fault	
7010	Value out of range	Value out of range	SYNC	Error	
7011	Subroutine could not be added to symbol table	The symbol table is an internal data structure. If information cannot be written to it, then probably there is not enough memory. Add more memory.	SYNC	Fault	
7012	Call could not be added to symbol table	The symbol table is an internal data structure. If information cannot be written to it, then probably there is not enough memory. Add more memory.	SYNC	Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7013	Undefined motion element in command	The motion element (axis) you are trying to use is undefined	Translation	Error	
7014	Axis cannot be added to symbol table	The symbol table is an internal data structure. If information cannot be written to it, then probably there is not enough memory. Add more memory.	SYNC	Fault	
7015	Axis is already defined	The axis being declared already exists. Use a different name for the axis.	Translation	Note	
7016	Internal error.	Contact technical support.	SYNC	Error	
7017	Unload all tasks first	Unload tasks in memory.	Terminal	Error	
7018	Internal translation error	Internal error	SYNC	Error	
7019	Variable does not exist	The variable you're trying to use doesn't exist. Make sure it has been declared.	Translation	Error	
7020	No default motion element: use the WITH instruction	You are trying to use a command without explicitly defining a motion element, and a default motion element has not been defined by the WITH instruction.	Translation	Error	
7021	Property valid for Axis only	Axis property only.	Translation	Error	
7022	Could not change axis name	Internal error. Contact technical support.	Translation	Error	
7023	Axis could not be created	Internal error. Contact technical support.	ROOT	Fault	
7024	Axis not created	Axis not created.	ROOT	Error	
7025	Too many values into vector	Too many values into vector	SYNC	Error	
7026	Too many variable names: simplify the expression	The maximum number of variables allowed in an expression is 32	Translation	Error	
7027	Instruction given in invalid context	The command you are trying to use cannot be used in this context. Check the allowed RCope of the instruction in the Reference Manual.	Translation	Error	
7028	PROGRAM must be on the first line	The PROGRAM keyword must be on the first line	SYNC	Error	
7029	Program symbol table not created	Internal error. An internal data structure could not be created. Add more memory or delete unneeded files.	SYNC	Fault	
7030	Call symbol table not created	Internal error. An internal data structure could not be created. Add more memory or delete unneeded files.	SYNC	Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7031	SUB symbol table not created	Internal error. An internal data structure could not be created. Add memory or delete unneeded files.	SYNC	Fault	
7032	CALL references non-existent SUB	You are trying to call a subroutine that does not exist. The subroutine must be defined.	Translation	Error	
7033	SUB is never called	The subroutine is never called in the program	SYNC	Note	
7034	Translator Initialization failure	Internal error. The Translator could not be initialized. Contact technical support.	ROOT	Fatal Fault	
7035	Translator syntax error	The syntax of the expression is wrong. Check correct syntax in Reference manual.	Translation	Error	
7036	Program structure error	The program must adhere to a well-defined structure. Refer to the section on Tasks in the User's Manual.	Translation	Error	
7037	Not enough space for parser stacks	Not enough space for parser stacks	SYNC	Error	
7038	Parser stack overflow	Parser stack overflow	SYNC	Error	
7039	Syntax Error	Syntax Error	SYNC	Error	
7040	Translator out of memory	Translator out of memory	SYNC	Error	
7041	Invalid numbers of drives	Invalid numbers of drives	SYNC	Error	
7042	Event definnition not allowed in event action	Event definnition is not allowed in event action	SYNC	Error	
7043	Event already defined in this program	Event already defined in this program	SYNC	Error	
7044	Could not create new event symbol.	Could not create new event symbol. Internal error	SYNC	Error	
7045	Unmatched ned of event definition block	Unmatched ned of event definition block	SYNC	Error	
7046	Parameter repitition not allowed	Parameter repetition not allowed	SYNC	Error	
7047	Undefined event	Undefined event	SYNC	Error	
7048	Label repeated in the same block	Label repeated in the same block	SYNC	Error	
7049	GOTO references non-exisiting label	GOTO references non-exisiting label	SYNC	Error	
7050	String too long (limit = 80 char)	String too long (80 characters)	SYNC	Error	
7051	Too many dimension in declaration	Too many dimension in a declaration (maximum number of dimensions is 10)	SYNC	Error	
7052	Number of dimension does not match delcaration	Number of dimension does not match delcaration	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7053	Label repeated in the same block	Label repeated in the same block	SYNC	Error	
7054	If block mismatch	If block mismatch	SYNC	error	
7055	While block mismatch	While block mismatch	SYNC	error	
7056	For block mismatch	For block mismatch	SYNC	error	
7057	Invalid array index	Invalid array index	SYNC	error	
7058	Name already declared as variable or axis	Name already declared as variable or axis	SYNC	error	
7059	Invalid number of coordinates	Contact technical support.	SYNC	error	
7060	Name of axis is invalid	Name of axis is invalid	SYNC	error	
7061	Variable cannot be deleted from the symbol table	Variable cannot be deleted from the symbol table	SYNC	error	
7062	Variable not declared : Not enough reserved memory space	There is not enough memory space to declare the variable	SYNC	Note	
7063	Error definition allowed only once in program	Error definition allowed only once in program	SYNC	error	
7064	Unmatched end of error definition block	Unmatched end of error definition block	SYNC	error	
7065	Command not allowed into OnError block	Command not allowed into OnError block	SYNC	error	
7066	Wrong index type of array. Index must be long	The type of the index of the array must be long	SYNC	error	
7067	Wrong input type. Input must be long Data Type	Wrong input type. Input must be long (This can occur when we are trying to querried 1.3 AND 1.4)	SYNC	error	
7068	Index of array must be a constant value	The number of elements in an array must be declared with a constant value.	SYNC	error	
7069	Reserved command name	Variables cannot be declared with the same name as a reserved command name.	SYNC	error	
7070	Too many nesting blocks	Too many nesting blocks	SYNC	error	
7071	With block mismatch	A With block definition must end with the End With statement	SYNC	error	
7072	Case Select block mismatch	Case Select block mismatch	SYNC	error	
7073	Invalid name of motion element	Invalid name of motion element	SYNC	error	
7074	Invalid property	Invalid property.	SYNC	error	
7075	Too many spaces	Too many consecutive spaces in a command	SYNC	error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7076	Motion element must be an axis	Motion element must be an axis	SYNC	error	
7077	Invalid motion element	Invalid motion element.	SYNC	error	
7078	This property isn't a system property	This property isn't a system property	SYNC	error	
7079	Wrong given master type	Wrong given master typee (3 master types currently defined)	SYNC	error	
7087	Dimension mismatch	Dimension mismatch for location. Example : A = B and dimension A <> dimension B		error	
7090	System camming element does not exist	System camming element does not exist		error	
7091	Camming element can only be a system element	Camming element can only be a system element (not a program variable)		error	
7092	Wrong input type for the select statement.	N/A		error	
7093	This expression cannot contain this unit	This expression cannot contain this unit. Example : ? i1 + i2 MMPS		error	
7094	Cannot execute the Drive command for axis	Cannot execute the Drive command for axis.		error	
7095	The HEX-keyword can only be used in a query command	The HEX-keyword can only be used in a query command	SYNC	Note	
7096	OnError can be defined only once in a program	OnError can be defined only once in a program	SYNC	Error	
7097	Incorrect print format	This error occurs if the print format for a print using statement is incorrect.	SYNC	Error	
7100	This property is a nodal only property	This property is a nodal only property	SYNC	Error	
7102	Try block mismatch	Try block mismatch	SYNC	Error	
7103	Cannot write a catch-case after the finally-case	A user cannot write another catch statement after the finally statement.	SYNC	Error	
7104	This property is a read-only property	Cannot assign a property to read only.	SYNC	Error	
7105	Undefined pls in command	Undefined pls in command	SYNC	Error	
7106	Pls could not be added to symbol table	A Pls could not be added to the symbol table. This is due to a memory fault.	SYNC	Error	
7107	Pls is already defined	Pls is already defined when the user wants to declare it.	SYNC	Error	
7108	Name of pls is invalid	Name of pls is invalid.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
7109	The with block must be closed before entering this block	The with block must be closed before entering a try block.	SYNC	Error	
7110	Cannot use locals in event block	Must use a global variable in the event conditions	SYNC	Error	
7111	The maximum length of the expression must be less than 128	The maximum length of the expression must be less than 128 characters.	SYNC	Error	
7112	Cannot move without target point	The target point is missing from the move command.	SYNC	Error	
7113	Expression can only contain strings	Expression can only contain strings	SYNC	Error	
7114	This function cannot be used as a condition	This function cannot be used as a condition.	SYNC	Error	
7115	The pls cannot be declared within a program	The pls cannot be declared within a program	SYNC	Error	
7116	Nesting of try statement is not allowed	Nesting of try statement is not allowed	SYNC	Error	
7117	Missing end onevent statement	Missing end onevent statement	SYNC	Error	
7118	Then statement missing	A then statement is missing in the if statement	SYNC	Error	

Interpreter (8000 through 8999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
8000	No Error	No Error	SYNC	Error	
8001	Division by zero	Division by zero.	SYNC	Error	Idle Task
8002	Stack underflow.	Interpreter stack underflow. The possible cause is memory corruption or Translator generated invalid code.	SYNC	Fault	Interpreter is prevented from execution.
8003	Stack overflow.	Memory exhausted.	SYNC	Fault	Interpreter is prevented from execution.
8004	Functions stack underflow.	Interpreter stack underflow. The possible cause is memory corruption or Translator generated invalid code.	SYNC	Fault	Interpreter is prevented from execution.
8005	Functions stack overflow.	Memory exhausted.	SYNC	Fault	Interpreter is prevented from execution.
8006	Array index underflow.	Invalid array index value.	SYNC	Fault	
8007	Array index overflow.	Invalid array index value.	SYNC	Fault	
8008	Task not found.	Task operation failed. Reason: requested task does not exist.	SYNC	Error	
8009	Invalid breakpoint location.	Attempt to set breakpoint to invalid location. Example: on comment line or on existing breakpoint.	SYNC	Error	
8010	Out of memory.	Memory exhausted. Add more memory or unload unnecessary tasks.	SYNC	Fatal Fault	
8011	End function error	Run time error in the external to interpreter function.	SYNC	Error	
8012	The task is still not terminated.	The task execution has not been terminated. This may occur if task is locked within some end-function, such as Move or Stop	SYNC	Error	
8013	The task is not stopped.	The task is not stopped (idled).	SYNC	Error	
8014	The task is terminated.	Task is terminated (killed).	SYNC	Error	
8015	Argument for EXP is out of range	The range of values for the EXP argument is +/- 7.09782712893383e+02. Values less than the lower limit can be used, but will return 0.	SYNC	Error	
8016	llegal mathematical function call	Invalid argument for mathematical function.	SYNC	Error	
8017	Argument for LOG is out of range	The argument to the LOG function must be greater than zero.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
8018	Negative parameter in SQRT operator	The argument to the SQRT function must be greater than or equal to zero.	SYNC	Error	
8019	Intepreter got invalid context definition.	Loader passes invalid context definition.	SYNC	Fatal Fault	
8020	Varible does not exist.	Variable for watch does not exist.	SYNC	Error	
8021	Wrong number of dimensions.	Wrong number of dimentions for watch.	SYNC	Fault	
8022	Task is not running.	Task is stopped (idled).	SYNC	Error	
8023	Element could not be deleted from symbol table.	Element could not be deleted from symbol table.	SYNC	Fault	
8024	Task must be killed first.	Task is still running. It may be locked in some end-function such as "Move".	SYNC	Error	
8025	Invalid task state for the `StartTask` command. Kill task first.	Task is not terminated (killed), it may be locked in some end-function such as "Move".	SYNC	Error	
8026	Bad memory address.	Attempted access to an invalid memory address. The error may be due to either a mistake in the application or to memory corruption.	SYNC	Error	
8027	Bad I/O address.	Attempted access to an invalid I/O address. The error may be due to either a mistake in the application or to memory corruption.	SYNC	Error	
8028	Overflow	Overflow in calculations.	SYNC	Error	
8029	Underflow	Underflow in calculations.	SYNC	Error	
8030	Invalid mutex ID	Invalid mutex ID. The error may be due to memory corruption.	SYNC	Fatal Fault	
8031	Invalid semaphore ID	Invalid mutex ID. The error may be due to memory corruption.	SYNC	Fatal Fault	
8032	Error creating the semaphore	Error while creating the semaphore. The error occurs when memory is exhausted.	SYNC	Fatal Fault	
8033	Invalid program checksum	Code segment has invalid check sum. The reason is memory corruption.	SYNC	Fatal Fault	
8034	Invalid operation code	Invalid token COP usually due to memory corruption.	SYNC	Fatal Fault	
8035	Task is interrupted by OnEvent or OnError	A task debugging command such as Step or StepOver, etc. is disabled due to an interrupted state of a task. The task switches to this state if it is interrupted by OnError or OnEvent.	SYNC	Error	
8036	Entry Station output buffer overflow	Entry Station output buffer overflow. Error probably is caused by an inoperable host, or user task sends too many messages.	SYNC	Note	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
8038	The value passed to the function is out of range	The value passed to the function is out of range	SYNC	Error	
8039	Nesting of TRY-block is not allowed.	Nesting of TRY-block is not allowed.	SYNC	Fault	
8040	Invalid time or date	Invalid time or date entered.	SYNC	Error	
8041	Nothing to retry.	Retry command is applicable anly after a run-time error.	SYNC	Error	
8042	Task is busy.	Task is busy; debugging is not allowed. This happens when task is inside the end function.	SYNC	Error	
8043	Element could not be deleted while programs are in memory.	Element could not be deleted while programs are in memory.	SYNC	Fault	
8045	Cannot stop unbreakable task.	Cannot stop or debug unbreakable task	SYNC	Error	
8046	Invalid Serial Number format	Invalid Serial Number format	SYNC	Error	
8047	Invalid Authorization code	Invalid Authorization code	SYNC	Error	
8049	Wrong type of variable	Wrong type of variable	SYNC	Error	
8050	Argument for trigonometric function is out of range	The maximum value of the argument to a sin(x) or cos(x) is 9.223372036854699e+18	SYNC	Error	
8051	The result of mathematical function overflows	The magnitude of the result is greater than the maximum value	SYNC	Error	
8052	Element could not be added to symbol table. Internal Error	Element could not be added to symbol table. Internal Error	SYNC	Fault	
8053	No permission: stop the motion first	Motion should be stopped before Reset.	SYNC	Fault	
8054	Serial number has invalid format.	Serial number has invalid format.	SYNC	Error	

Recorder (9000 through 9999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
9001	Recorder task cannot be created: add memory	The recorder task cannot be created. This may occur if there is not enough memory. Add memory or unload tasks that are not necessary.	SYNC	Error	
9002	Cannot create recorder mutex	Internal error.	ROOT	Fatal Fault	
9003	Recorder task already exists	Only one instance of the Recorder is allowed	SYNC	Error	
9004	Invalid record gap value: must be a positive value	The record gap must be a positive value.	SYNC	Error	
9005	Too many record variables	Up to 6 variables may be specified for recording	SYNC	Error	
9006	Invalid number of record points: must be a positive value	Number of points must be a positive value	SYNC	Error	
9007	Not enough memory	Not enough memory for record operation. Add memory, or unload tasks that are not necessary. This can happen if the RECORD command specifies more data than can be stored in the available free memory.	SYNC	Error	
9008	Insufficient disk space to store recorded data	Record data are stored on the RAM disk. There is not enough free space on the disk to store the recorded data. Delete files fom the RAM disk and then try executing the RECORD command or the RECORDCLOSE command again.	SYNC	Error	
9009	Disk I/O operation fault	Internal error. Contact technical support.	SYNC	Error	
9010	Failed to store recorded data	Failed to store recorded data on RAM disk.	SYNC	Error	
9011	Synchronization error. Recorder did not manage to run within a single cycle.	This error will occur if you attempt to record data that cannot be available immediately to the recorder, and that therefore result in the recorder operation not completing before the end of the cycle. This can happen, for example, if you try to record drive data that need to be accessed from the service channel.	ASYNC	Error	
9012	Creation of Data segment failed	Internal error.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
9013	Creation of System segment failed	Internal error.	SYNC	Error	
9014	Failed to run Interpreter's agent	Internal error.	ASYNC	Error	
9015	Invalid MutEx ID	Internal error.	SYNC	Fatal Fault	
9016	Invalid record file extension: must be REC	Invalid file extension specified for recorder file. Only the REC extension is allowed.	SYNC	Error	
9017	Recorder hasn't been initialized	The RECORD command has to be successfully executed before the RECORDON, RECORDOFF or RECORDCLOSE commands can be executed.	SYNC	Error	
9018	Wrong index of recording variable	Internal error. Recording variable index is out of range.	ASYNC	Error	
9019	Recording already has been completed	The RECORDON and RECORDOFF commands cannot be executed if the Recording process has already been completed. Execute the RECORDCLOSE command in order to save the recorded data.	ASYNC	Note	
9020	Unknown Recorder state	Internal error	ASYNC	Fatal Fault	
9021	Unknown error	Invalid error code recognized by the Recorder task.	SYNC	Fatal Fault	

Event Handler (10000 through 10999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
10000	No Error	No Error	SYNC	Note	
10001	Event does not exist	Event does not exist	SYNC	Error	
10002	Too many events defined	To many events defined	SYNC	Error	
10003	Invalid event task id.	Failed to create an event handling task. This may occur during start up.	ROOT	Fatal Fault	
10004	Invalid mutex id	Invalid mutex id	SYNC	Fatal Fault	
10005	Invalid semaphore id	Invalid semaphore id	SYNC/ASYNC	Fatal Fault	
10006	Invalid event message queue id	Invalid message queue id	SYNC/ASYNC	Fatal Fault	
10007	Memory allocation fail	Memory allocation failed	SYNC	Error	
10008	Invalid operation code	Invalid operation code for operation with internal linked list	ASYNC	Fatal Fault	
10009	Invalid RTS element	Invalid RTS element otained. It could happen at start up.	ROOT	Error	
10010	Event condition not specified	Event condition not specified. Condition pointer is NULL	SYNC	Fatal Fault	
10011	Error checking event condition.	Event condition function call failed	ASYNC	Error	
10012	Event invalid handle	Event invalid handle	SYNC	Fatal Fault	
10013	Interpreter invalid handle	Invalid pointer to Intepreter internal registers is used.	SYNC	Fatal Fault	
10014	Failed to delete event entry	Failed to delete event entry	SYNC	Error	
10015	Task does not exist	Invalid event task name specified	SYNC	Note	
10016	Event action task is active	Event task is active (running at the moment of event deletion)	SYNC	Error	
10017	Event action is not specified	Pointer to action code is NULL	SYNC	Fatal Fault	
10018	Failed to create event mutex id	Error creating mutual exclusion semaphore for event handler	ROOT	Fatal Fault	
10019	Failed to create semaphore id	Error creating synchronization semaphore for event handler	ROOT	Fatal Fault	
10020	Failed to create event message queue id	Error creating message queue for event handler	ROOT	Fatal Fault	
10021	Invalid RCanrate specified	Bad value of RCan rate	SYNC	Error	
10022	Unknown Error	Unknown Error	SYNC	Fatal Fault	

Backend Processor (11000 through 11999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
11000	No Error	No Error	SYNC	Note	
11001	%d:COP does not match its number.	Internal error. Contact technical support.	Translation	Error	None
11002	Error at line %d of the table of mnemonics. Token name already exists.	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
11003	Symbol table of token mnemonics is full.	The symbol table allocated for token mnemonics is full. There is not enough memory available to create an internal data structure. Add more memory.	ROOT	Fatal Fault	Watchdog
11004	Unable to create symbol table for mnemonics.	There is not enough memory available to create an internal data structure. Add more memory.	ROOT	Fatal Fault	Watchdog
11005	%d:Unable to create symbol table for user names(labels).	There is not enough memory available to create an internal data structure. Add more memory.	ROOT	Fatal Fault	Watchdog
11006	Unable to delete symbol table for mnemonics.	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
11007	Unable to delete symbol table for user names(labels) .	Internal error. Contact technical support.	ROOT	Fatal Fault	Watchdog
11008	%d:Name `%s` already defined.	Internal error. Contact technical support.	SYNC	Error	Idle Task
11009	%d:Symbol table of user names(labels) is full.	Not enough memory for translation. Add memory, or unload tasks that are not necessary.	SYNC	Error	Idle Task
11010	%d:Token mnemonic `%s` is invalid (unknown).	Internal error. Contact technical support.	SYNC	Error	Idle Task
11011	%d:Number of parameters at line does not match the token `%s`	Internal error. Contact technical support.	SYNC	Error	Idle Task
11012	%d:This token type is not supported yet.	Internal error. Contact technical support.	SYNC	Error	Idle Task
11013	%d:Symbol or label `%s` has not been defined.	Internal error. Contact technical support.	SYNC	Error	Idle Task
11014	%d:Calculated length of the token `%s` does not match its predefined value.	Internal error. Contact technical support.	SYNC	Error	Idle Task
11016	%d:Out of disk space.	Out of disk space while attempting to write temporary file to RAM drive. Add more memory or delete REC files.	SYNC	Error	Idle Task
11019	Invalid Error code	Internal error. Contact technical support.	SYNC	Fatal Fault	Watchdog

Internal Communication (12000 through 12999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12001	Service Channel not open	Drive has indicated that it cannot open the service channel. Contact technical support.	SYNC	Error	
12002	MDT telegram processing overrun	Overlap between reference generation and transmission. Try using a higher baud rate, longer cycle time, and reducing the amount of cyclic data.	ASYNC	Error	
12003	Interrupt Service Routine Overlap: use longer cycle time.	ISR's duration is too long (more than one communication cycle).	SYNC	Error	
12004	Service channel timeout waiting for drive	Internal error. Timeout during service channel transmission. Contact technical support.	SYNC	Error	
12005	Service channel timeout while drive is busy	Timeout while the Service channel is busy.	SYNC	Error	
12006	Undefined error number	Internal error. Undefined error code	SYNC	Fatal Fault	
12007	Axis cannot be enabled: check C1 and Remote Enable	This error occurs if the *PosiDrive RC* times out while trying to enable the drive. A drive cannot be enabled if the drive is reporting a C1 error, or if the drive's hardware enable signal is Off.	SYNC	Error	Set CONMODE=2 and toggle SYS.MOTION.
12008	Axis cannot be disabled	Contact technical support.	SYNC	Error	
12009	Invalid access to closing the Service Channel	Drive has indicated that it cannot close the service channel. Contact technical support.	SYNC	Error	
12010	Axis cannot be enabled: check C1 and Remote Enable	A drive cannot be enabled if the drive is reporting a C1 error, or if the drive's hardware enable signal is Off.	SYNC	Error	Set CONMODE=2 and toggle SYS.MOTION.
12011	Axis cannot be disabled	Contact technical support.	SYNC	Error	
12012	Drive not ready for power up	A drive cannot be enabled if the drive is reporting a C1 error, or if the drive's hardware enable signal is Off.	SYNC	Error	Set CONMODE=2 and toggle SYS.MOTION.
12013	Drive reports fault in C1.	When a drive fault occurs, the drive decelerates to a stop and releases torque.	ASYNC	Error	Set CONMODE=2 and toggle SYS.MOTION.
12014	RESERVED		SYNC	Fatal Fault	
12015	RESERVED		SYNC	Fatal Fault	
12016	RESERVED		SYNC	Fatal Fault	
12017	No access is defined in the drive	Contact technical support.	SYNC	Error	
12018	RESERVED		SYNC	Fatal Fault	
12019	RESERVED		SYNC	Fatal Fault	
12020	RESERVED		SYNC	Fatal Fault	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12021	Invalid access to the element 1	Element 1 is read-only.	SYNC	Error	
12022	Bad handle-function index	Internal error. Contact technical support.	SYNC	Error	
12023	Service channel data not initialized	Internal data structures had not been allocated yet. Internal error. Contact technical support.	SYNC	Error	
12024	Wrong communication phase: refer to Reference Manual	The command cannot be executed in the current communication phase. Refer to the Limitations of the instruction in the Reference Manual.	SYNC	Error	
12025	Invalid drive address: check if axis is Simulated	There may be a conflict between the axis DriveAddress and Simulated properties. If an axis is simulated, the drive address must be set to 0. If the axis is real, the Simulated property must be set to 0 (Off).	SYNC	Error	
12026	Internal error.	Internal error.	SYNC	Fatal Fault	
12027	Internal error.	Internal error.	SYNC	Error	
12028	Wrong AT number.	Internal error.	SYNC	Error	
12029	Not enough memory.	Not enough memory to allocate internal data structures. Add memory or unload unnecessary tasks.	SYNC	Error	
12030	Internal error.	Internal error.	SYNC	Error	
12031	No memory to maintain Service container	There is no memory within DPRAM to maintain Service container data structure.	SYNC	Error	
12032	Service transfer not ready	Internal error. Previous service transfer not ready	SYNC	Error	
12033	No name	Element 2 has not been assigned a name	SYNC	Error	
12034	Name transmission too short	Drive expects more information.	SYNC	Error	
12035	Name transmission too long.	Drive expects less information .	SYNC	Error	
12036	Name cannot be changed	The name of IDN may not be changed (in accordance with IEC1491).	SYNC	Error	
12037	Name is write-protected at this time	The name cannot be changed in the current communication phase.	SYNC	Error	
12038	Service transfer data unavailable	Internal error. No data available for the service transfer.	SYNC	Error	
12039	Initialization error	An error occured during initialization.	ROOT	Fatal Fault	
12040	Service channel handshake time-out.	Service channel handshake time-out. Drive does not acknowledge service transmission.	SYNC	Error	
12041	Missing telegram(s): communication interrupted	Controller didn't receive telegram from the drive(s) in communications phase 2. This error is generated when a drive stops functioning.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12042	DPRAM overflow.	Not enough DPRAM space to allocate data structures. Try using less data in the cyclic data.	SYNC	Error	
12043	Data element too long	Cannot transmit very long data through the Service channel.	SYNC	Error	
12044	Error calculating T2: increase cycle time or baud rate	Error calculating MDT starting time. There is an expected time overlap between the AT's and the MDT. Either increase the cycle time, increase baud rate, or simplify the telegrams.	SYNC	Error	
12045	Error calculating T3	Error calculating command value valid time. The time calculated for T3 exceeds 1 ms.	SYNC	Error	
12046	Error calculating T4	Error calculating feedback acquisiton capture point. The time calculated for T4 exceeds 1 ms.	SYNC	Error	
12047	Error calculating TEND	Error calculating end of transmittion time.	SYNC	Error	
12048	No service data	Information field is probably empty - Internal Error.	SYNC	Error	
12049	Service channel hand-shake time-out	Service channel handshake time-out. Drive does not acknowledge service transmission.	SYNC	Error	
12050	Attribute transmission too short	Internal error.	SYNC	Error	
12051	Attribute transmission too long	Internal error.	SYNC	Error	
12052	Attribute cannot be changed	Element 3 is write protected. Attribute cannot be changed.	SYNC	Error	
12053	Attribute is write protected at this time	Cannot change the attribute in the current communication phase.	SYNC	Error	
12054	Service transfer not error-free	Cannot guarantee error free service channel communication with the drive	SYNC	Error	
12055	Missing telegram(s): communication interrupted	Controller didn't receive telegram from the drive(s). This error is generated if there is a timing problem. Communication interrupted due to missing telegram(s).	ASYNC	Error	Bring the ring down to CP0
12057	Wrong predefined data telegram number	Data telegram type number is out of range (0..7).	SYNC	Error	
12058	Wrong element number.	The element range is 1..7.	SYNC	Error	
12059	Communication phase 3 transition check failed	Execution of procedure was completed in the drive with error.	SYNC	Error	
12060	Communication phase 4 transition check failed	Execution of procedure was completed in the drive with error.	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12061	"Error creating MutEx for the Service channel task"	Unable to create MutEx semaphore for the Service channel task.	SYNC	Fatal Fault	
12062	"Cannot create MsgQ to provide service transmission"	Unable to create message queue	SYNC	Fatal Fault	
12063	"Error creating Service event semaphore"	Unable to create Service event semaphore	SYNC	Fatal Fault	
12064	Can't pass communication phase 1: drive address(es) not declared.	Drive addresses must be declared.	SYNC/ASYNC	Error	
12065	No units	(in accordance with IEC1491).	SYNC	Error	
12066	Unit transmission too short.	(in accordance with IEC1491).	SYNC	Error	
12067	Unit transmission too long	(in accordance with IEC1491).	SYNC	Error	
12068	Unit cannot be changed	(in accordance with IEC1491).	SYNC	Error	
12069	Unit is write protected at this time	(in accordance with IEC1491).	SYNC	Error	
12070	Invalid value assignment	Invalid value assignment at this statement.	SYNC	Error	
12071	Cannot proceed to communication phase 1: check baud rate and drive addresses	This error occurs if the system cannot be advanced to communication phase 1. This can happen if the baud rates in the drives and controller are not matched. It can also happen if there is a conflict between the DriveAddress property and the Simulated property. If an axis is simulated, the drive address must be set to 0. If the axis is real, the Simulated property must be set to 0 (Off).	SYNC/ASYNC	Error	
12072	The drive address has already been assigned to another axis	Each axis must be assigned a unique drive address. There may not be multiple drives with the same address.	SYNC	Error	
12073	Not valid for simulated axis	Cannot perform this command for simulated axis	SYNC	Error	
12074	Invalid request for service channel transmission	The message received by the Service channel task has an incorrect structure.- Internal error	SYNC	Fatal Fault	
12075	"Invalid data pointer"	Invalid pointer to internal data structure .- Internal error	SYNC	Error	
12076	"Uknown operation type for this command"	Internal error	SYNC	Error	
12077	Cannot redefine default	Defaultcannot be redefined.	SYNC	Error	
12078	"List is too long"	The length of the list declared by an user is too long	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12079	Cannot enable axis: System Enable property is off	A drive cannot be enabled if the System.Enable property is OFF. Set this property to on to allow the drives to be enabled, and then enable the axis.	SYNC	Error	
12080	RESERVED		SYNC	Fatal Fault	
12081	No minimum value	(in accordance with IEC1491).	SYNC	Error	
12082	Minimum value transmission too short.	(in accordance with IEC1491).	SYNC	Error	
12083	Minimum value transmission too long	(in accordance with IEC1491).	SYNC	Error	
12084	Minimum value cannot be changed.	(in accordance with IEC1491).	SYNC	Error	
12085	Minimum value is write protected at this time	(in accordance with IEC1491).	SYNC	Error	
12086	Error with the drive	Contact technical support.	ASYNC	Note	
12087	Return back to CP0 due to a missed telegram	Telegram missed on CP1 or CP2.	SYNC	Error	
12088	An error occurred on the drive	Drive displays an error occurrence in its status word.	ASYNC	Error	
12089	"Drive doesn't respond"	The drive does not send answer as it expected.	ASYNC	Note	
12090	Drive telegram error	Telegram received from the drive is errorneous	ASYNC	Note	
12091	Item not defined	Contact technical support.	SYNC	Error	
12092	Wrong operation data length	Wrong operation data length was specified.	SYNC	Error	
12093	RESERVED		SYNC	Fatal Fault	
12094	RESERVED		SYNC	Fatal Fault	
12095	RESERVED		SYNC	Fatal Fault	
12096	RESERVED		SYNC	Fatal Fault	
12097	No maximum value.	(in accordance with IEC1491).	SYNC	Error	
12098	Maximum value transmission too short.	(in accordance with IEC1491).	SYNC	Error	
12099	Maximum value transmission too long	(in accordance with IEC1491).	SYNC	Error	
12100	Maximum value cannot be changed.	(in accordance with IEC1491).	SYNC	Error	
12101	Maximum value is write protected at this time	(in accordance with IEC1491).	SYNC	Error	
12114	Operation data transmission too short.	(in accordance with IEC1491).	SYNC	Error	
12115	Operation data transmission too long.	(in accordance with IEC1491).	SYNC	Error	
12116	Operation data cannot be changed	(in accordance with IEC1491).	SYNC	Error	
12117	Operation data are write protected at this time.	(in accordance with IEC1491).	SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
12118	Operation data are smaller than the minimum value.	(in accordance with IEC1491).	SYNC	Error	
12119	Operation data are greater than the maximum value.	(in accordance with IEC1491).	SYNC	Error	
12120	Invalid data (e. .g, invalid bit combination).	The value you try to write is out of range.	SYNC	Error	
12121	Operation data are password write-protected	Operation data are password write-protected	SYNC	Error	

Root Process (16000 through 16999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
16026	Config.prg failed	Config.prg failed, see error history and retrieve trn.err for more details.	ASYNC	Fatal Fault	Watchdog
16032	Autoexec.prg failed	Autoexec.prg failed, see error history and retrieve trn.err for more details.	ASYNC	Error	

Encapsulation (17000 through 17999)

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
17000	Overload fault	Motor overload	ASYNC	Error	
17001	Amplifier over temperature fault	Drive over temperature	ASYNC	Error	
17002	Motor over temperature fault	Motor over temperature	ASYNC	Error	
17003	RESERVED		ASYNC	Error	
17004	Control voltage fault (analog supply failure)	Analog supply failure (±12V)	ASYNC	Error	
17005	Feedback loss fault	FeedBack loss	ASYNC	Error	
17006	Commutation fault		ASYNC	Error	
17007	Over current fault	Drive over current fault	ASYNC	Error	
17008	Over voltage fault	Bus over voltage	ASYNC	Error	
17009	Under voltage fault	Bus under voltage	ASYNC	Error	
17010	RESERVED		ASYNC	Error	
17011	Excessive position deviation	PE>PEMAX or PE overflow fault	ASYNC	Error	
17012	Communication interface fault		ASYNC	Error	
17013	Software limit switch fault	PFB>PMAX or PFB<PMIN fault	ASYNC	Error	
17014	RESERVED		ASYNC	Error	
17015	Non-volatile data memory fault	Non-volatile data memory fault	ASYNC	Error	
17016	Non-volatile data memory checksum fault	Non-volatile data memory checksum fault	ASYNC	Error	
17017	Internal Error		ASYNC	Error	
17018	Internal Error		ASYNC	Error	
17019	Internal Error		ASYNC	Error	
17020	Internal Error		ASYNC	Error	
17021	Internal Error		ASYNC	Error	
17022	Internal Error		ASYNC	Error	
17023	Invalid drive or motor configuration	No compensation fault	ASYNC	Error	
17024	Motor over speed fault	Motor over speed fault	ASYNC	Error	
17025	Internal error		ASYNC	Error	
17026	Internal Error		ASYNC	Error	
17027	Synchronization Error		ASYNC	Error	
17028	Synchronization Error		ASYNC	Error	
17029	External communication fault	Synchronization in DPRAM fault	ASYNC	Error	
17030	Internal firmware fault. Contact factory		ASYNC	Error	
17031	Positioner fault. Check SYS.MOTION flag	Positioner fault	ASYNC	Error	
17032	Invalid configuration mode		SYNC	Error	
17033	Cannot execute while active		SYNC	Error	
17034	Invalid configuration number		SYNC	Error	

Error #	Error Message	Error Description	Data Type	Severity	Immediate Action
17035	Invalid axis number		SYNC	Error	
17036	Failed to create PCA MsgQ	Failed to create PCA MsgQ	ROOT	Fault	
17037	Failed to create PCA task	Failed to create PCA task	ROOT	Fatal Fault	
17038	Failed to receive a message from the procedure command agent	Failed to receive a message from the procedure command agent	SYNC	Fault	
17039	Error in procedure command	Error in procedure command	SYNC	Error	
17040	Cannot execute command	Cannot execute command	SYNC	Error	
17041	Error in sending message to the procedure command agent	Error in sending message to the procedure command agent	SYNC	Fault	
17042	Error in setting or getting the priority of the procedure command agent	Error in setting or getting the priority of the procedure command agent	SYNC	Fault	
17043	Internal procedure command agent error	Internal procedure command agent error	SYNC	Fault	
17044	Value should be positive	Value should be positive	SYNC	Error	
17045	Value out of range	Value out of range	SYNC	Error	

Customer Support

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APPENDIX A

Differential Input

For many applications, simple pulse and direction stepper motor controllers are matched up with ***PosiDrive*** amplifiers. The positioning capability of the ***PosiDrive*** makes this a very desirable approach to controlling motion with standard low-cost controllers. One particular challenge is the compatibility between the pulse and direction output and the encoder equivalent input on the ***PosiDrive***.

The ***PosiDrive***, for noise immunity purposes, uses a differential line receiver for the pulse input from the controller. Whereas many step motor controllers have available a single-ended output. This is not a direct "connect the wires and off you go" issue. There are a few different methods to establish connectivity between the two servo devices.

One method is to utilize biasing resistors on the inverting input to the line receiver. This is to ensure that the output of the device will switch according to the desired input from the controller. Usually, two biasing resistors of 300 Ohms are used, which get connected to +5V and ground. This is illustrated in Figure A-1.

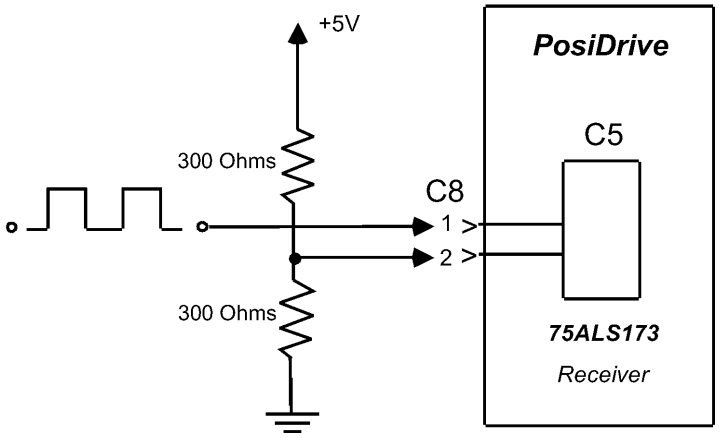

Figure A - 1: RChematic of Biasing Resistors on Line Receiver

This method works, but is prone to noise and the values of the resistors could change (depending on the cable length). The input must be biased at a proper level for the non-inverting input to change states of the output.

The more desirable the method (a more robust solution) is to utilize a compatible line driver chip (illustrated below).

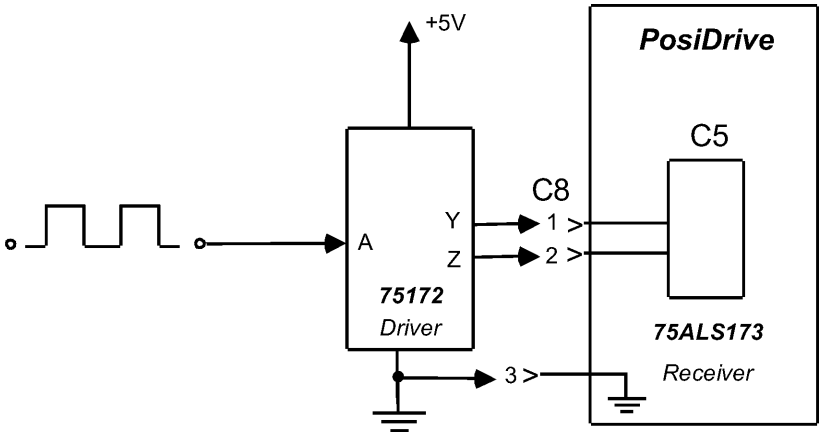

Figure A - 2: RChematic of Line Driver to Line Receiver

This way, the input received from the driver chip is ensured to be compatible with the ***PosiDrive***. This chip is the 75172, which is the companion to the line receiver (75LS173) on the input to the ***PosiDrive***. The connection here is the C8 input located on the top of the ***PosiDrive*** and has a 9-pin "D" shell connector. Figure A-2 shows a typical interface to achieve a noise immune connection of a single-ended output to a differential input on the ***PosiDrive***.

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